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Recent Foraminiferal Faunules From the Louisiana Gulf Coast.

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RECENT FORAMINIFERAL FAUNULES FROM THE LOUISIANA GULF COAST

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by
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ABSTRACT

The Lower Mississippi River delta is an area of active sedimentation receiving an estimated two million tons of material daily via the Mississippi River. This sediment is being deposited in bodies of water which differ in such physical properties as salinity, temperature, and depth. Variations in these environmental factors influence or possibly control the distribution of life which in turn determine the nature of the organic remains incorporated with the sediment deposited.

This study of the Recent foraminiferal faunules from the environments of the Lower delta stemmed from an investigation of the mudlumps at the mouths of the passes of the Mississippi River conducted for the New Orleans District, Corps of Engineers, U. S. Army. Following the discovery of an unique and prolific foraminiferal assemblage in the sediments of mudlump SP-5 off South Pass, an extensive investigation of the foraminiferal genera and species of the present environments in the Lower Mississippi River delta was initiated. The foraminiferal faunule in the clay of mudlump SP-5 was an index to the environment inhabited by the foraminifera when they were living and thus was a clue to the magnitude of vertical displacement of the clay since the time it was originally deposited as mud in the Gulf of Mexico.

Published reports on two previous investigations of the foraminiferal populations in the Lower delta did not satisfy the nomenclatural need in conjunction with the study of SP-5. One report restricted to a study of beach material from the Rio Grande to the Mississippi River described eighteen species and varieties of foraminifera. The other report presented the distribution of the foraminifera in Recent

sediments as determined from a traverse across the continental shelf with the results of the investigation being presented at the generic level. No species were described.

The major contribution of this study is the taxonomic analysis of foraminifera from the mudlumps and environments in the Lower Mississippi River delta. A total of 258 species and varieties distributed among 104 genera are described and figured of which five genera, thirty-eight species, and eleven varieties are reported as new. This detailed analysis has enabled the writer to establish the foraminiferal species indices of the different environments which had not been done by previous investigations and on the basis of these data to establish the original environment of deposition of the mudlump clay.

On the basis of material recovered from environments sampled in the vicinity of Southwest, South and Southeast passes, the littoral environments contributed only negative information in the mudlump study. The species of the near-shore brackish-water assemblages, so distinctively exhibited in the tidal channels and streams and in the inland bays are not represented in the mudlump assemblages. The beaches and distributaries reflect the foraminiferal faunules of the adjacent environments, normally the environment abutting the beach and into which the distributary discharges.

The environment of the living correlative of some mudlump faunules appears to be the neritic zone. The foraminiferal faunule of SP-5, however, which constitutes over eighty-eight percent of the total number of species described in this report is characterized by an assemblage of foraminiferal genera and species not present in any of the neritic samples taken by the writer. Environmental conditions similar to those

occupied by the SP-5 faunule, when living, probably lies beyond the area of active delta growth in deeper water than was sampled. Credence to this assumption can be found in a series of samples taken off the coast of Texas and Florida by other investigators which the writer has examined. On the basis of these samples it is concluded that the probable original area of deposition of the mud now constituting the clay of SP-5 was in water deeper than 450 feet, and that the probable magnitude of vertical displacement of the clay in SP-5 is in excess of 400 feet.

INTRODUCTION

Objectives. This dissertation on Recent foraminiferal faunules[1] from the Louisiana Gulf Coast has two objectives: 1) to present the foraminiferal faunules recovered from sediment collected in the Lower Mississippi River delta; and 2) to present a taxonomic study of the foraminiferal genera and species represented.

Area investigated. The sediment analyzed during the course of the study was collected in the vicinity of Southwest Pass, South Pass, and Southeast Pass, three of the major distributaries of the Mississippi River. (See fig. 1.) Representative samples from all the distinct environments in this portion of the lower delta were obtained, including samples of the "clay islands," commonly referred to as "mudlumps," which have formed at the mouths of all the major passes of the Mississippi River.

History of investigation. This study of the foraminifera of the Louisiana Gulf Coast stemmed from an investigation of the mudlumps of the Lower Mississippi River delta conducted for the New Orleans District, Corps of Engineers, U. S. Army, under the authority granted by the Chief of Engineers, Washington, D. C., dated 28 January 1948.[2] The bulk of the field work was completed during the summers of 1948 and

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[1] Glaessner (1949) after Fenton (1928). An assemblage of fossils preserved in a single stratum of limited vertical and horizontal extent.

[2] Co-worker in the investigation was Mr. James P. Morgan of the Louisiana State University Geology Department staff, who is preparing a companion dissertation on the distribution, structure, and origin of mudlumps.

1949, the equipment used in collecting the samples being furnished by the Burrwood Substation of the New Orleans District. The laboratory work was pursued, as time permitted, over a period of three years (1948-1950), utilizing space and equipment made available in the Geology department, Louisiana State University.

As the laboratory work progressed, it became evident that the taxonomic study of the foraminifera could not be brought to a satisfactory conclusion without examining the type specimens described by the late Dr. J. A. Cushman from the Atlantic Ocean.

In the later summer of 1949, the species which had been recovered from the mudlump and environment samples examined, were compared with Cushman's types deposited in the U. S. National Museum, Washington, D. C., and at the Cushman Laboratory of Foraminiferal Research, Sharon, Massachusetts. Most of the specific identifications in the taxonomic analysis of the foraminifera not described as new, are based upon comparison with types in the Cushman collection.

Previous investigations. The nomenclatural difficulties experienced by the writer in the preparation of this report were those which would be inherent to a pioneer study of an area, despite the fact that there have been two previous investigations of the foraminiferal population in the Lower Mississippi River delta.

Kornfeld (1931) presented a check list of 18 species (broadly referring to both species and varieties) of foraminifera recovered from 27 samples of Recent beach material collected along the coast of the Gulf of Mexico from the Rio Grande to the Mississippi River. (See fig. 1.) Only 12 of these 18 species were described and 7 of the 18 were figured.

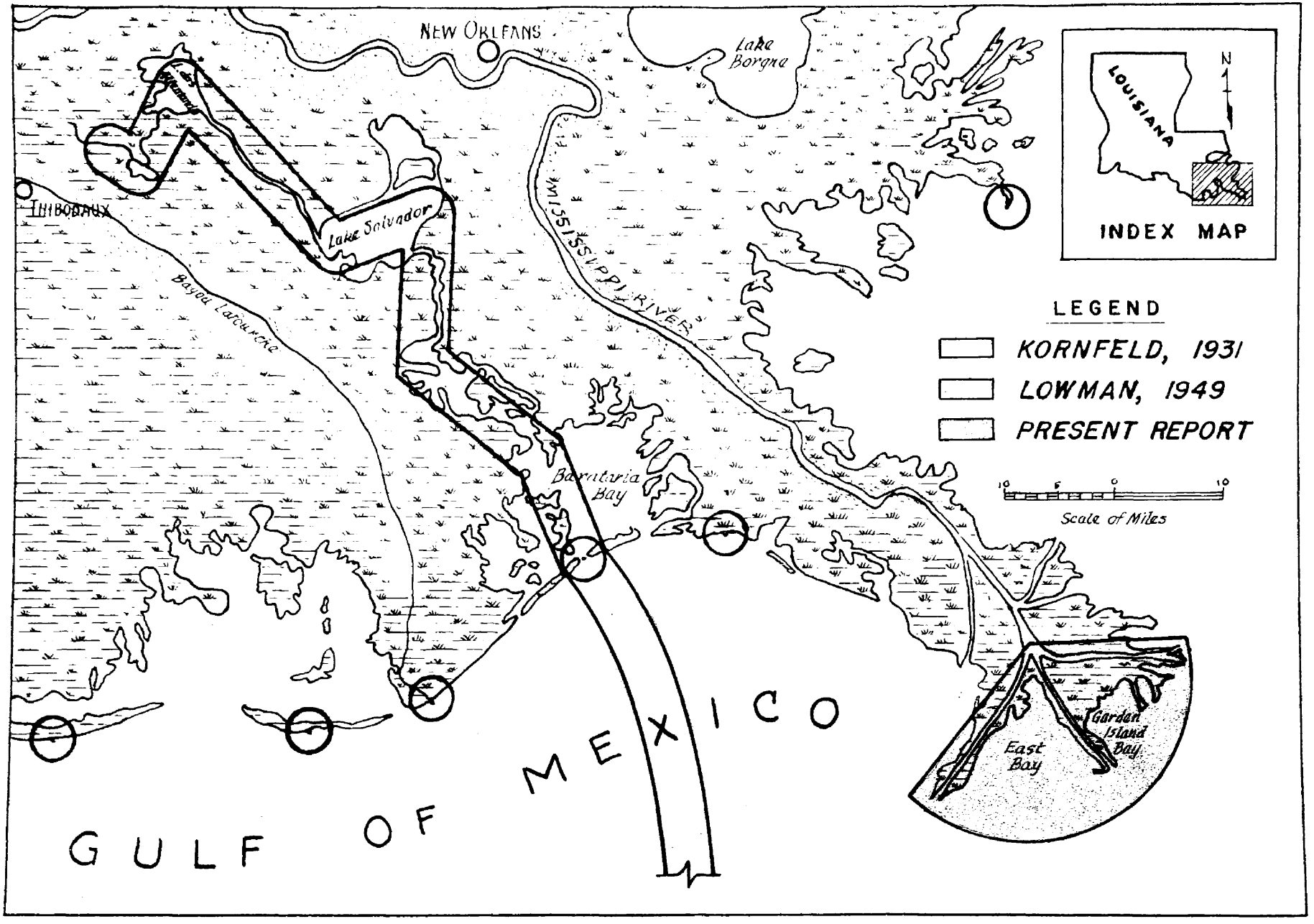

Figure 1. Area covered by present and previous investigations of the Lower Mississippi River delta.

Lowman (1949) presented the distribution of the foraminifera in the Recent sediments of the Gulf of Mexico as determined from traverses across the continental shelf and slope in three different areas: Corpus Christi, Mississippi delta, and Pensacola. Of these three areas traversed by Lowman, the investigation in the Mississippi delta was by far the most complete and the most important to the present study. A series of samples was collected from the fresh-water cypress swamps near Lake Boeuf, east of Thibodaux, Louisiana, through Lac des Allemands, Lake Salvador, Barataria Bay, and thence into the Gulf of Mexico to a point beyond the continental slope, 8,000 feet below sea level. (See fig. 1.) The object of the investigation, as stated by Lowman (p. 1951), "was to improve our knowledge of the significance of foraminiferal faunas in terms of environment." But the manner in which this was accomplished, precludes the use of his report in any taxonomic analysis, even when the foraminifera are recovered from the same general area in which the traverse was made. This relationship of the foraminifera to the environment or the environmental control on the distribution of foraminifera (both situations being presented) is evaluated at the generic level. These generalized faunule data can best be used in the environmental analysis of fossil assemblages in which Recent genera, but not Recent species, are represented.

Methods used in sampling environments. Two samples were collected at nearly every station: 1) a core or grab sample; and 2) a sample of the upper surface of the bottom sediment which was placed in either alcohol or formaldehyde to preserve the associated living organisms.

In the shallow water, the sample collected for a possible ecological study of the environment was obtained by pumping water at a given station

through a 200-mesh screen. The residue on the screen was then transferred to a small bottle to which was added a sufficient quantity of alcohol to preserve any living forms. Cores were obtained by forcing a 1-1/2-inch copper cylinder into the bottom sediment, the sample recovered being preserved in a glass jar.

In the traverse off South Pass, and at isolated stations in the deeper water off Southwest Pass, the sampling device consisted of a lead weight and fusiform-shaped screen tied together with a short length of airplane cable. (See fig. 2.) This unit was dragged on the Gulf bottom, the weight agitating the bottom sediment, the screen trailing behind to collect some of the material stirred-up by the lead weight. The material from the screen was preserved in formaldehyde to be used in an ecological study. Grab samples of the bottom sediment, collected in a piece of steel pipe attached to the lead weight, were preserved in glass jars.

The sampling device used in collecting material for an ecological study of the deeper environments was not entirely satisfactory. In several samples, there was evidence that the screen had dug into and become filled with bottom sediment. In any future work of a similar nature, certain modifications would have to be made in the sampler employed by the writer in order to assure completely satisfactory results for the effort and time expended. The present sampler might prove satisfactory if three runners were added around the perimeter of the screen to prevent it from touching botton. Any new unit constructed might be improved by using some metal in the framework lighter than copper but of equal strength and resistance to salt water.

Localities collected. An arbitrary location number has been given the environment and mudlump stations sampled. The numbers designated

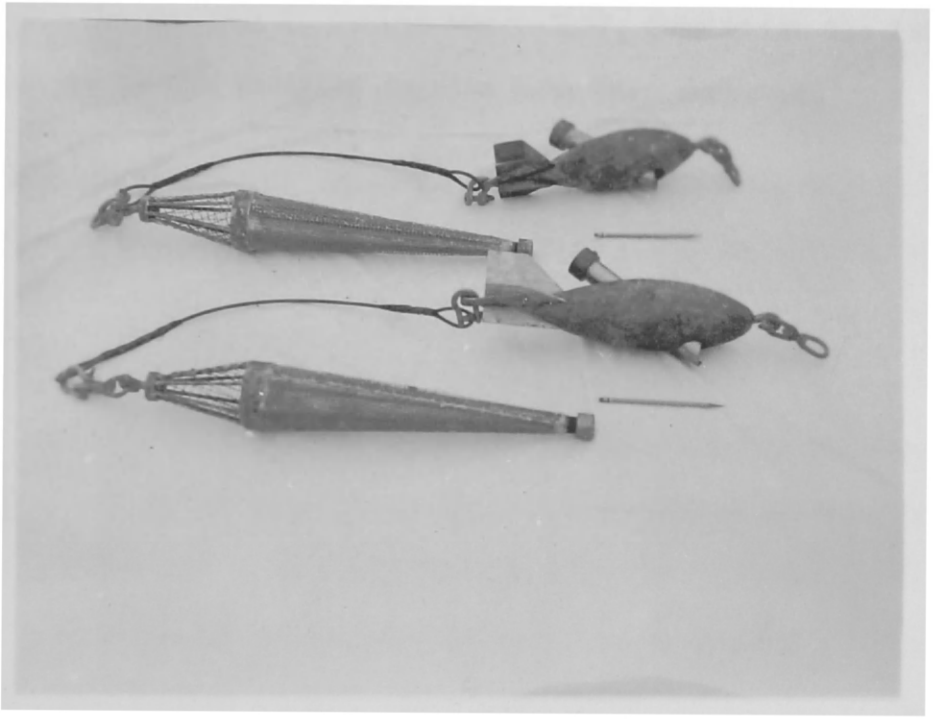

Figure 2. Sampling device used in collecting sediment from the Continental Shelf.

(See Appendix I) correspond with the numbers in the location maps, figures 3 and 4, and the numbers in the check list of foraminiferal genera and species, Table I.

For greater detail of the environmental localities collected, the reader is referred to the U. S. Coast and Geodetic Survey Air Photo Compilation sheets T-5403, T-5404 and T-5407, from which the latitude and longitude of the stations sampled have been computed.

DESCRIPTION OF ENVIRONMENTS SAMPLED

The environments sampled for a study of their contained foraminiferal remains are those most in evidence in the Lower Mississippi River delta. They are described briefly, principally to review the conditions under which the majority of the foraminiferal genera and species lived and died.

Tidal channels. The tidal channels and streams which occur in the marshlands adjacent to the passes represent, at least in part, distributaries that have been abandoned. The movement of water through their sinuous courses is in accord with the tides. Little if any fresh water is added by the parent stream, at least not enough to flush the channel or decrease the salinity which approaches that of the adjacent marine water.

The bottoms of these channels contain a mass of organic muck of an undetermined thickness. Carbonized plant debris constitutes the major material in the muck, although the remains of animals which lived in the mud and in the water above are well represented in any sample collected.

In the recovery of foraminiferal remains, bottom material from the tidal channels produces the largest quantity and greatest number of species per unit volume of any of the brackish-water environments examined. A similar observation was recorded by Brady and Robertson (1870, p. 3):

> "The situation which seems to be the most favourable to the growth and multiplication of these animals (ostracoda and foraminifera) are quite sheltered pools which are never left entirely dry by the tide, are unswept by strong currents, and thus able to retain permanently a bed of soft mud. Many species there are, of course, which prefer different conditions; but it is in such localities that we find our gatherings richest, both as to number of individuals and in variety of species."

Beaches. Students of coastal terminology differ widely in the definition of "beach." Some regard the beach as an area; others consider the beach a material. Normally the two are coexistent, but in the delta it is possible to find beach material without a true beach area.

Beaches are present only in a few places in the vicinity of the passes. Sand beach (material and area) occurs to the east of Southwest Pass (collection locality 4) and on the west side of South Pass. Shell-beach material occurs on top the marsh along the western edge of Stake Island, with a small shell-beach area located on the north side of Mud Bay (collection locality 3). Samples taken of the South Pass beach were found to be so badly contaminated with foraminiferal remains from the adjacent mudlumps that they were not included in the present study.

The lateral extension of beach material seaward to and including the off-shore bars is known to extend several hundred yards beyond the mouth of South Pass. Samples from this area are not included in the present analysis since the sand was also obviously contaminated with foraminiferal remains derived from the mudlump clay.

Distributaries. The major distributaries of the Mississippi River in the lower delta are called "Passes." Minor distributaries diverging from these passes are usually referred to as "bayous," although there is no absolute consistency in local usage of the terms.

This is the environment in which extreme and rapid changes in the saline content of the water occur. During high-water stage, the water may be fresh enough to drink at the point of discharge into the Gulf of Mexico. During low-water stage in extreme cases, the water in the Mississippi River may have such a high saline content that it is not potable south of New Orleans, Louisiana, a distance of approximately

120 miles from the mouth of Southwest Pass.

Bays. The bays sampled are those which occupy the areas between the finger-like extensions of the passes of the Mississippi River. Those bays, for the most part, are triangular-shaped extensions of the Gulf of Mexico bounded by the levees and land areas adjacent to the passes.

The magnitude of the waterway connection between the bays and the Gulf is so great that the physical property of the water in the bay, especially at the off-shore margin, is essentially the same as that of the open Gulf. At the inner margin, where most of the samples of this environment were obtained (collection localities 21, 23 and 24), the marine water of the Gulf is somewhat diluted by the fresh water being discharged from the adjacent distributaries.

Redfish Bay (collection locality 22) has a slightly different physical setting than the other three bay localities studied. The waterway between Redfish Bay and the Gulf is somewhat restricted by a group of mudlumps and sandbars extending to the west of Southeast Pass. The discharge of fresh water into the bay is negligible. In many respects the environmental condition in Redfish Bay is much more closely related to the tidal channels (collection localities 1-3) than to collection localities 21, 23 and 24 in East Bay and Garden Island Bay.

Neritic zone. The bottoms of the oceans and seas are divided into physiographic relief provinces in much the same manner as the exposed portion of the continents. The basis of subdivision in both is difference in elevation of the land surface, the ocean relief being measured in the number of feet below mean sea level.

That portion of the continent on which the oceans overlap is called the Continental Shelf; the steepened slope of the ocean bottom beyond

the Continental Shelf is referred to as the Continental Slope. The standard depth below sea level assigned to the boundary between the Continental Shelf and Continental Slope is 600 feet. According to Lowman (1949, p. 1953), this boundary in the Mississippi delta traverse "takes place at a narrow depth range at about 300 feet."

The terms Continental Shelf and Continental Slope, sensu stricto, refer to the physiographic divisions of the ocean bottom, and, therefore, in a technical sense can not be used when discussing the life on these respective divisions and in the water above. The corresponding "life zones" commonly used are neritic (continental shelf) and bathyal (continental slope).

The Continental Shelf was sampled at 3 widely separated stations off the mouth of Southwest Pass (collection localities 25 - 27), and along a traverse extending from the mouth of South Pass gulfward to a depth of 380 feet (collection localities 28 - 34). The "striking" faunal change at 300 feet observed by Lowman in the Mississippi delta traverse, which according to him marks the boundary between the neritic and bathyal zones, is not in evidence in the South Pass traverse.

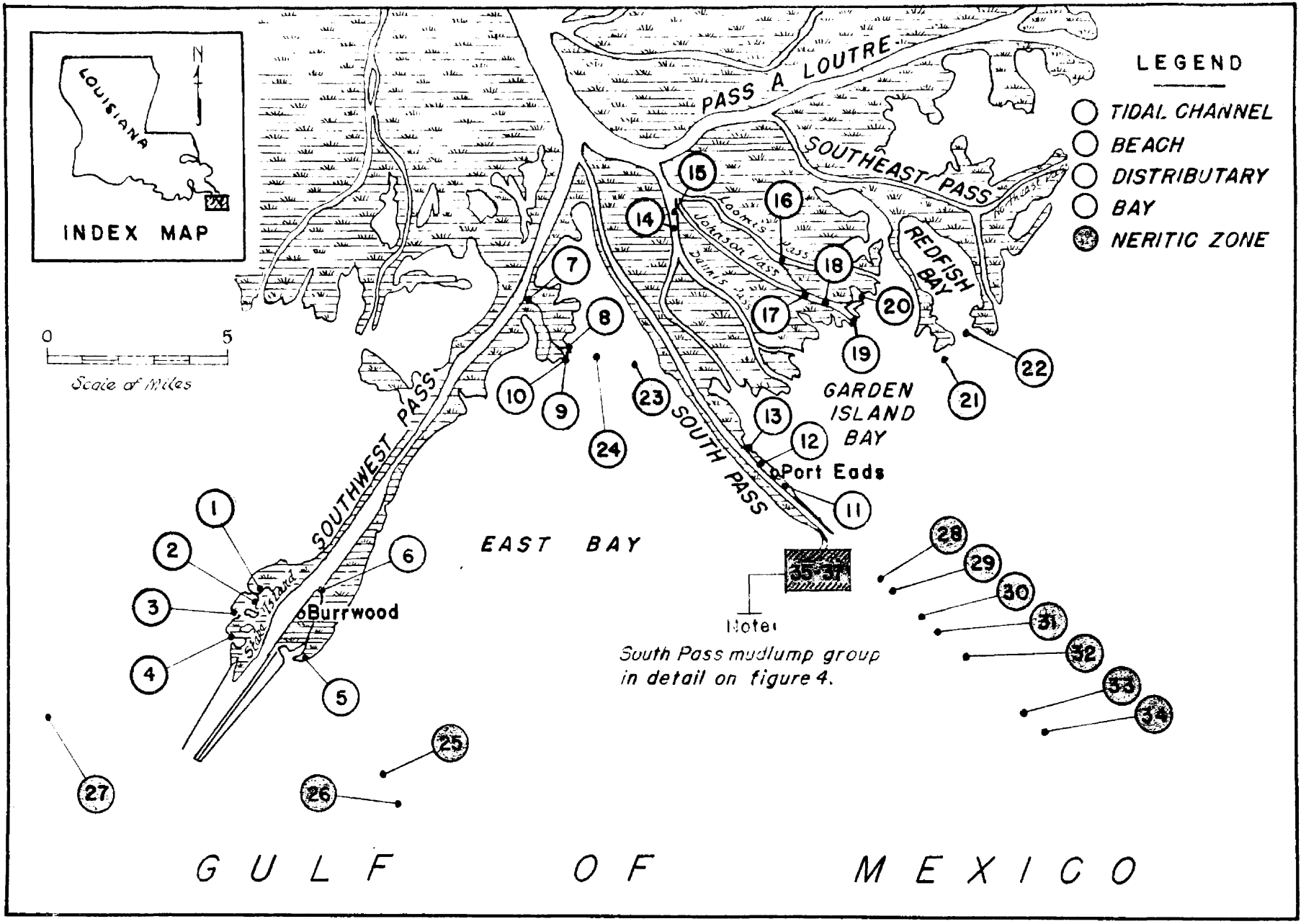

Figure 3. Environmental localities sampled.

ANALYSIS OF ENVIRONMENTAL FORAMINIFERAL FAUNULES

The extent to which any one of the environments in the lower delta could be sampled for a study of their contained foraminiferal remains was largely determined by the size of the boat used in the field work and to a limited extent by the weather. The inland environments, readily accessible and not subject to storms severe enough to make navigation hazardous, are well represented in the present study. The neritic environments, entirely inaccessible with the normal equipment assigned to the investigators, are represented by a limited number of stations with as few as one sample for some depths of water. The number of samples from each environment used in this report is:

Tidal channels	3	samples
Beaches	2	"
Distributaries	15	"
Bays	4	"
Neritic zone	10	"

In fulfilling the needs of the present study, no statistical analysis of the foraminiferal content of a sample has been undertaken. The check list prepared, Table I, shows the genera and species present, which satisfies one of the objectives of this report, but leaves the reader with a distorted picture of the true environmental fauna that would be reflected by the relative proportions of the genera and species in a sample. The forms which are indigenous to the environment (the fauna) should exceed in number of specimens that portion of the faunule which is intrusive. It is impossible to work with a group of faunules recovered from the same type of environment without becoming conscious

of the predominance of certain species, which even in a detailed statistical analysis would be considered indices of the environment.

The analysis of the environments is presented in a number of conclusions, based on: 1) laboratory observations made in the course of the investigation; and 2) a review of the foraminiferal genera and species listed in Table I.

Conclusions. 1) The environmental samples collected have provided a list of the basic foraminiferal genera and species being incorporated with the sediments of the Lower Mississippi River delta. Notable contributions are three new genera: Arenoparrella and Bisaccium described from the brackish water assemblage, and Ammobulimina, from the neritic zones.

2) The number of samples from each environment collected does not afford a finished environmental analysis of the foraminiferal faunules recovered. On the basis of the information at hand, which can best be appraised by the individual reader, the following conclusions are presented regarding the distribution of foraminiferal genera and species in the sediments in the vicinity of South and Southwest Passes:

Inland Brackish Environment (tidal streams and restricted bays)

Ammoastuta salsa

Arenoparrella mexicana n. gen.

Bisaccium imbricatum n. gen.

Elphidium gunteri galvestonensis

Haplophragmoides balizensis n. sp.

Haplophragmoides manilensis n. sp.

Nonion crawfordi n. sp.

Nonion faringai n. sp.

Rotalia beccarii parkinsoniana

Trochammina inflata

Trochammina cf. *rotaliformis*

Inner Neritic (based on abundance of forms listed)

Ammobaculites burrwoodensis n. sp.

Ammobaculites diversus

Bulimina exilis diminuta n. var.

Nonionella cf. *auris*

Pseudoparrella howei n. sp.

Rotalia beccarii tepida

Textularia burrwoodensis n. sp.

Outer Neritic (edge of continental shelf)

Ammobulimina mexicana n. gen.

Bolivina acerosa southpassensis n. var.

Bolivina subaenariensis mexicana

Bulimina marginata

Bulimina pyrula

Nonionella basiloba

Robulus calcar

Uvigerina cf. *hispido costata*

Virgulina schreibersiana

3) The beach material reflects principally the foraminiferal faunule of the environment which supplied the sediment. This normally is the environment abutting the beach.

4) The fluctuation in the saline content of the water in the distributaries lends itself to a mixing of fresh- and brackish-water forms, manifested in the ostracoda assemblage but not in the foraminifera.

The latter more nearly resembles the brackish-water faunules of the adjacent bays.

ANALYSIS OF THE MUDLUMP FORAMINIFERAL FAUNULES

The standard foraminiferal faunules used as a basis for comparing the foraminiferal remains from widely separated mudlump groups in the Lower Mississippi River delta, were established in a study of samples taken from 11 mudlumps located on the west side of South Pass. In this group of samples, two basic faunule patterns were recognized: 1) a sparse faunule characterized by distinctive species of four foraminiferal genera (Bulimina, Pseudoparrella, Nonionella and Rotalia); and 2) a prolific faunule (containing representatives of most of the invertebrate phyla) characterised by an apparently endless number of foraminiferal genera, of which the most diagnostic appear to be Liebusella, Textulariella, and Vaginulinopsis. The intermediate assemblages at South Pass could be satisfactorily assigned to either of the two groups above.

The three samples used in the present study (collection localities 35 - 37) depict the representative foraminiferal faunules of the two basic patterns recognized at South Pass. Nothing would be gained by introducing more samples collected from mudlump areas at the other passes, since they conform within reasonable limits to the sparse South Pass pattern.

Mudlump SP-1. SP-1 is the largest island in the South Pass mudlump group. It is an irregular mass of bluish-black clay of about two acres in extent, which stands, at its highest point, about 11 feet above mean tide. It is devoid of vegetation but usually abounds in sea gulls and the residue therefrom.

SP-1 is one of the two well-sampled mudlumps at South Pass. In 1948 a hand-drilling crew forced two holes into SP-1, one to a depth of

100 feet, the other to a depth of 40 feet. Samples were collected at 5-foot intervals with a cup-type sampler attached to the end of the pipe which was forced into the clay. In 1949, SP-1 was again sampled at depth, this time with a Jeep-mounted rotary drilling rig.

The object of this subsurface sampling was two-fold: 1) to ascertain the structure; and 2) to determine the thickness of the clay mass. The results of this subsurface sampling briefly summarized are: 1) the clay is not homogeneous through the entire mass; 2) the 5-foot and 100-foot samples are homogeneous, in that 75 percent of the material in each are particles the consistency of clay (grain-size of 0.005 mm. or less); and 3) the total depth of the clay mass had not been penetrated.

A surface sample, collected on the eastern edge of SP-1 (See fig. 4), was used in this study. The foraminiferal remains recovered from this sample (See Table I) and other samples from SP-1 not included in this report, exemplify the sparse faunule characterized by four genera and species: Bulimina exilis diminuta, Nonionella cf. auris, Pseudoparrella howei, and Rotalia beccarii tepida.

Mudlump SP-3. SP-3 is a small, lenticular-shaped island which lies at the northwestern margin of the South Pass mudlump group. It is composed of bluish-black clay, which in contrast to SP-1 is stratified, the apparent dip being northwest 5 to 10 degrees.

SP-3 was included in the subsurface operations of 1948 and 1949. The hand-drilling crew forced a hole into the clay to a depth of 60 feet; the rotary-drilling rig successfully completing a test to a depth of 117.5 feet from the surface of the mudlump. In neither case was the thickness of the clay mass determined.

The foraminifera recovered from a surface sample taken at the

western margin of SP-3 (collection locality 36) reflects the faunule pattern of SP-1. (See Table I.)

Mudlump SP-5. Located in the central southern portion of the South Pass mudlump group, SP-5 consists at mean sea level of a few pinnacles of mud scattered over an elliptical area roughly 25 feet across and 75 feet in length, composed of clay of three different colors. At extremely low tide it can be seen that the center of the mudlump is of light-gray clay and the sides of irregular bands of grayish-red and bluish-black clay. Some contacts between the different colors are abrupt and well defined.

The change in the character of the clay at SP-5, as compared with SP-1 and SP-3, is also accompanied by a change in the nature and quantity of organic remains present. All three materials are extremely fossiliferous, the light-gray clay being more aptly described as prolific. The quantity of fossiliferous material present in the latter suggests that it is at least in part a concentrate of the organic remains removed by wave action from the adjacent grayish-red and bluish-black clay masses. The light color could be due to the increased number of white organic particles per unit volume of material.

A surface sample of the light-gray clay in the center of mudlump SP-5 (collection locality 37) produced the foraminiferal faunule presented herein as being representative of the "prolific" pattern. It is unique to South Pass, and in the associated mudlump group is repeated either wholly or in part at only SP-4, SP-6, and SP-9. (See fig. 4.)

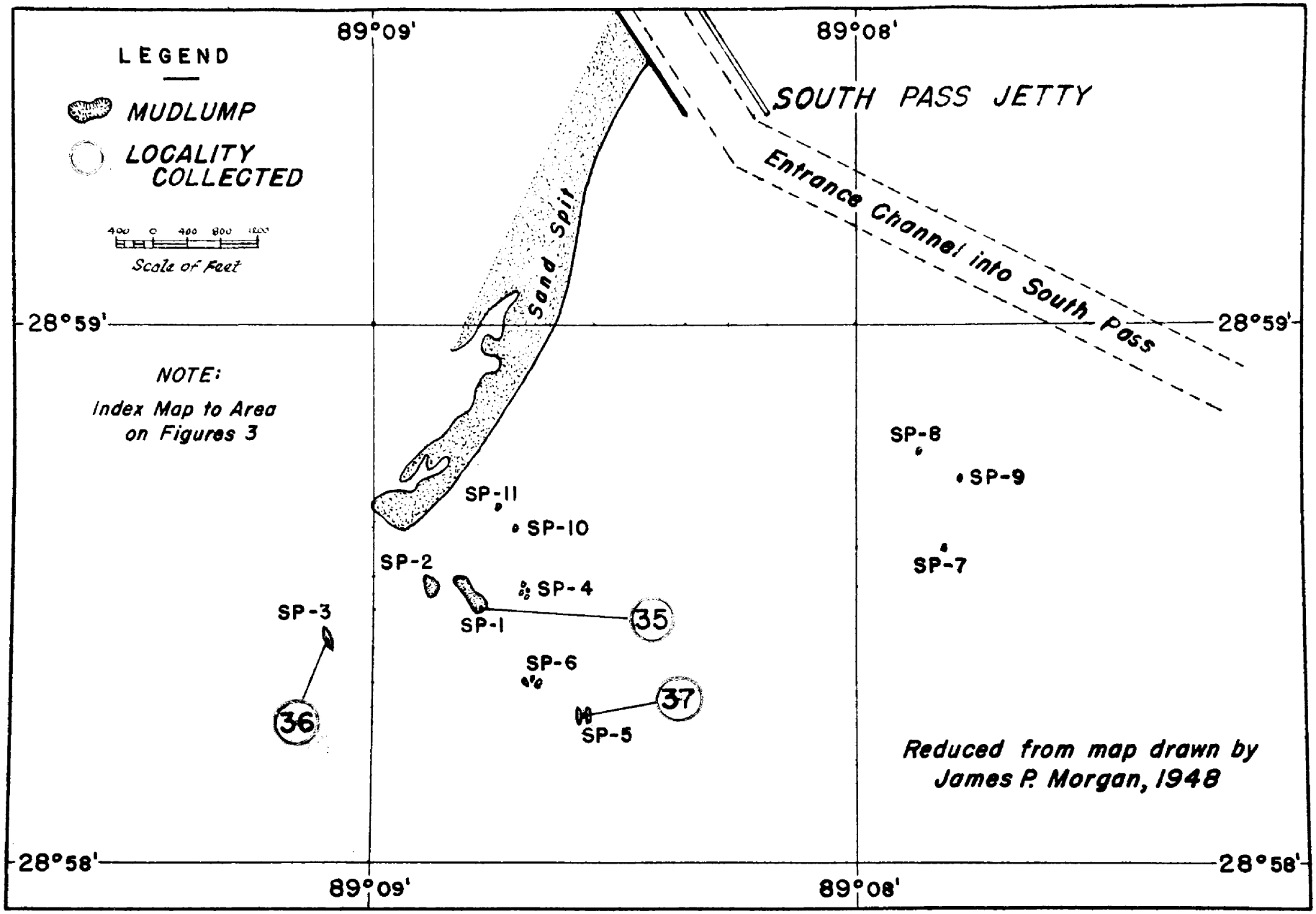

Figure 4. Collection localities in mudlump group off South Pass.

Contributions to the mudlump problem. The foraminiferal faunule of SP-5 is a major contribution to the mudlump investigation of the Lower Mississippi River delta, not only from the standpoint of increasing knowledge of the foraminiferal population of the northern portion of the Gulf of Mexico, but in answering one and suggesting an answer to a second mudlump problem left unsolved by previous investigators, i.e.,: 1) the original area of deposition; and 2) the amount of vertical displacement of the mudlump clay.

The area of original deposition of the clay is evidential in the SP-5 faunal assemblage consisting of echinoderm carapace and spine fragments, mollusca (pelecypods and gastropods), bryozoa, coral, ostracoda, and foraminifera. This group of animals could only live or be gathered together in a marine environment.

A clue as to the magnitude of the vertical displacement of the mudlump clay, not determined by mechanical means at SP-1 and SP-3, lay in a comparison of the mudlump faunule with collections from the Gulf of Mexico. An inference drawn, despite its many inherent inaccuracies, is that the present position of the mudlump faunule, minus the depth below sea level of the same assemblage in the sediments of the Gulf of Mexico, would approximate the amount of vertical movement of the mudlump clay. Assuming that the identical assemblage could be found in the sediments presently being deposited, the major inaccuracy in the above postulate lies in the fact that the time of deposition of the mudlump clay is unknown, and thus the amount of subsidence in the area since deposition of the mudlump clay can not be computed.

The samples collected by the writer from the neritic zone in the vicinity of South and Southwest passes, have only a negative value in

locating the present environmental equivalent of the SP-5 faunule. The closest affinity can be found in the 380-foot sample (collection locality 34), but the large arenaceous foraminiferal genera of the SP-5 assemblage are missing. This could indicate that: 1) the environmental conditions similar to those occupied by the SP-5 faunule can be found only beyond the area of active delta growth; or 2) that the SP-5 faunule can be found only in a deeper environment than the one sampled. There is even a greater possibility that both factors enter into the picture.

Admittedly based upon the thinnest possible line of evidence, the only solution to the enigma of the environmental status of the SP-5 foraminiferal faunule appears to be in an evaluation of three genera present in the assemblage: Liebusella, Textulariella, and Vaginulinopsis. According to Dr. S. W. Lowman[3], Vaginulinopsis may occur in some abundance in sediment deposited beneath 400 to 450 feet of water, and the Liebusella-Textulariella association with Vaginulinopsis may occur as shallow as 400 to 450 feet.

Conclusions. 1) Mudlump SP-5 has made the largest single contribution of foraminiferal genera and species recorded from any sediment in the Lower Mississippi River delta. A total of 94 genera, 201 species, and 28 varieties were recognized of which two genera (Aaptostoma and Frondiculonodosaria), 27 species, and 10 varieties are described as new.

2) The species of the genus Robulus can best be identified on the basis of their apertural pattern.

3) The geological age of the foraminiferal remains from the mudlumps is Recent, since all species recovered have either been observed in

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[3]Personal communication, 1948.

sediment collected from the Gulf of Mexico or reported from Recent sediments in other parts of the world.

4) The faunal assemblage recovered from SP-5 is conclusive evidence that the original environment of deposition of the mudlump clay was marine.

5) The foraminiferal species which characterize the SP-1 and SP-3 faunule, Bulimina exilis diminuta, Nonionella cf. auris, Pseudoparrella howei, and Rotalia beccarii tepida, can be found in abundance in the inner neritic to mid-neritic zones.

6) The clay in mudlumps SP-1 and SP-3 was originally deposited in a shallower marine environment than the clay in SP-5.

7) The magnitude of the vertical displacement of the clay in SP-5 is probably in excess of 400 feet.

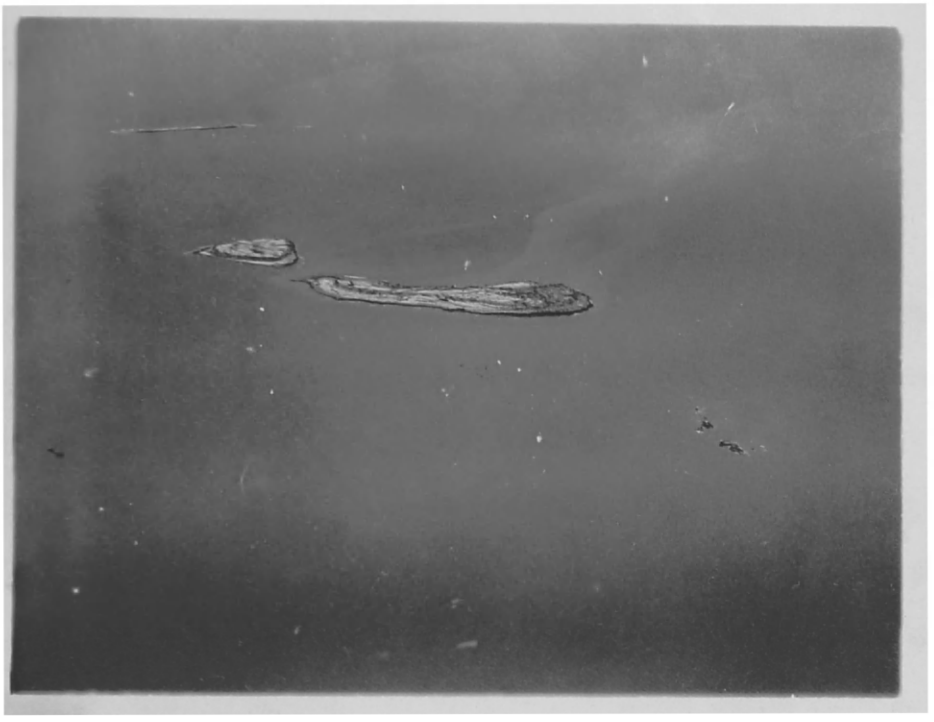

Figure 5. An aerial view of four mudlumps off South Pass. SP-4, the small islands in right foreground; SP-1, large island in center of photo; SP-2, circular island near SP-1; and SP-3, lenticular island in upper left corner of photograph. Photo by Corps of Engineers, U. S. Army.

TAXONOMY OF THE FORAMINIFERAL FAUNULES

Phylum PROTOZOA

Order FORAMINIFERA

Family SACCAMMINIDAE

Genus SACCAMMINA M. Sars, 1869

SACCAMMINA sp. "A"

Plate I, fig. 1

Test free, spherical; wall of fine sand grains firmly cemented; aperture a single, circular opening. Maximum diameter of figured specimen (H. V. Howe Coll. No. 4205) 0.12 mm.

These specimens have the external appearance of S. sphaerica G. O. Sars as figured by Cushman (U. S. Nat. Mus., Bull. 104, 1918, pl. 19, figs. 2-5), but the size differentia is so great that the two can not be considered the same species. Cushman's specimens range from 1.0 to 3.5 mm. in diameter. The specimens in this material are consistently less than 0.2 mm. in diameter.

Genus PROTEONINA Williamson, 1858

PROTEONINA DIFFLUGIFORMIS (H. B. Brady)

Plate I, fig. 2

Reophax difflugiformis H. B. Brady, 1879, Quart. Journ. Micro. Sci., vol. 19, p. 51, pl. 4, figs. 3a, b.

Typical of the unilocular, chitin-lined, agglutinated forms assigned to this species. It is abundant in the inner neritic sediments but not present in the mudlump clay.

Length of hypotype (H. V. Howe Coll. No. 4206) 0.33 mm.

Family REOPHACIDAE

Genus REOPHAX Montfort, 1808

REOPHAX DENTALINIFORMIS H. B. Brady

Plate I, fig. 3

Reophax dentaliniformis H. B. Brady, 1881, Quart. Journ. Micro. Sci., vol. 21, p. 49.

A single specimen from an inner neritic sample appears to satisfy the requirements of this species.

Length of hypotype (H. V. Howe Coll. No. 4207) 0.6 mm.

Family LITUOLIDAE

Genus AMMOASTUTA Cushman and Bronnimann, 1948

AMMOASTUTA SALSA Cushman and Bronnimann

Plate I, fig. 4a, b

Ammoastuta salsa Cushman and Bronnimann, 1948, Contr. Cushman Lab. Foram. Res., vol. 24, pt. 1, p. 17, pl. 3, figs. 14-16.

Compared with holotype (Cushman Coll. No. 56638) from mangrove swamps of the Gulf of Paria, Trinidad. In the present material, this species occurs in the near shore and tidal stream deposits. None have been found in the mudlump clay.

Length of hypotype (H. V. Howe Coll. No. 4208) 0.4 mm.

Genus HAPLOPHRAGMOIDES Cushman, 1910

HAPLOPHRAGMOIDES BALIZENSIS Andersen, n. sp.

Plate I, figs. 7a, b

Test relatively small; wall extremely fragile, composed of finely arenaceous material with much cement, surface smooth; completely involute coiled; periphery broadly rounded; sutures slightly curved and only slightly depressed; 7 to 8 chambers in last formed coil. The aperture is a low arched opening at the base of the last chamber, typically with a slight lip. Early chambers with a thick chitin lining. Maximum diameter of holotype (H. V. Howe Coll. No. 4209) 0.5 mm.; thickness 0.27 mm.

This species appears to be very similar to H. involvens Cushman and McCulloch described from Alaska, but lacks the sigmoid sutures and pronounced overhanging lip. H. trullissata (H. B. Brady), reported from the Pacific and Atlantic has a much more acute periphery. In external appearance, H. balizensis could easily be confused with Cyclammina bradyi Cushman except that an examination of the broken specimens will reveal that the former has no labyrinthic interior.

H. balizensis n. sp. is abundant in the inner neritic sediment but has not been found in any of the mudlump clay.

HAPLOPHRAGMOIDES MANILENSIS Andersen, n. sp.

Plate I, figs. 6a, b

Test evolute coiled, biumbilicate; exterior wall of fine grained, poorly cemented arenaceous material on a chitin base, surface relatively smooth but not glossy; 8 to 9 chambers in last formed whorl, inflated, increasing in size as added but not in regular sequence; periphery

broadly rounded and lobulate; sutures straight, greatly depressed. The aperture is an inconspicuous slit at the base of the final chamber. Maximum diameter of holotype (H. V. Howe Coll. No. 4211) 0.7 mm.; thickness 0.33 mm.

This species has the same general appearance as H. mauricensis Howe and Ellis, but has a much larger and broader final chamber. This characteristic alone is sufficient to differentiate between the two species.

H. manilensis occurs in sediments from the inner neritic zone.

HAPLOPHRAGMOIDES cf. PLANISSIMA Cushman

Plate I, fig. 5

Haplophragmoides planissima Cushman, 1927, Calif. Univ. Scripps Inst. Oceanogr. Bull., Tech. Ser., vol. 1, p. 135, pl. 1, fig. 6.

The outstanding characteristics shared by H. planissima Cushman and these specimens are: 1) a compressed test and 2) a wall composed of coarse, angular quartz grains and mica flakes very poorly cemented. They disagree in such features as size of test and amount of compression; the holotype (U.S.N.M. Cat. No. 20289) being larger; the paratype (U.S.N.M. Cat. No. 40349) being much more compressed than the specimens in the material examined.

Maximum diameter of figured specimen (H. V. Howe Coll. No. 4210) 0.7 mm.; thickness 0.25 mm.

Genus AMMOBACULITES Cushman, 1910

AMMOBACULITES cf. AGGLUTINANS (d'Orbigny)

Plate I, fig. 8

Spirolina agglutinans d'Orbigny, 1846, Foram. Foss. Vienne, p. 137, pl. 7, figs. 10-12.

These specimens appear to be similar to the A. agglutinans (d'Orbigny) of many authors but were found to be smaller, less coarsely arenaceous and more globose than a topotype from the Miocene of Baden b. Wein, Austria (Cushman Coll. No. 16954). Length of figured specimen (H. V. Howe Coll. No. 4212) 0.9 mm.; breadth of uniserial portion 0.30 mm.

This species is abundant in the inner neritic and inland brackish environments. It has not been observed in the mudlump clay.

AMMOBACULITES BURRWOODENSIS Andersen, n. sp.

Plate I, fig. 11

Test small, extremely compressed; early portion close coiled, uncoiled portion gradually decreasing in size with final chamber so constricted as to give the appearance of having a slight neck; about 4 chambers in coiled portion, 3 in the uncoiled segment; sutures straight indistinct; test material extremely fragile, composed of clear angular sand grains firmly united with a very thin layer of cement; exterior quite rough. The aperture is an elliptical opening at the apex of the final chamber. Length of holotype (H. V. Howe Coll. No. 4213) 0.55 mm.; breadth 0.24 mm.; thickness 0.15 mm.

This species is different from any reported from the Gulf of Mexico-Carribean area, particularly the Gulf of Paria, Trinidad, B. W. I., in which there appears to be a somewhat similar faunulo. The most

similar species described from that region is A. directus Cushman and Bronnimann. The uncoiled portion of test in A. directus has nearly parallel sides whereas in A. burrweedensis, n. sp. the chambers in the uncoiled segment decrease in size as added.

This species is common in the inner neritic sediments but has not been observed in the mudlump clay.

AMMOBACULITES DIVERSUS Cushman and Bronnimann

Plate I, fig. 10

Ammobaculites diversus Cushman and Bronnimann, 1948, Contr. Cushman Lab. Foram. Res., vol. 24, p. 38, pl. 7, figs. 5-6.

The specimens so abundant in the inner neritic sediments examined are more closely related to the paratypes of A. diversus than the holotype (Cushman Coll. No. 56760). The differences are minor and not consistent, but the majority of the specimens in the writer's hypodigm are larger and have more diagonal sutures.

Length of hypotype (H. V. Howe Coll. No. 4214) 0.6 mm.

AMMOBACULITES SOUTHPASSENSIS Andersen, n. sp.

Plate I, fig. 9

Test small; early coil slightly compressed, uncoiled portion round with parallel sides; aperture terminal with small, round opening; uncoiled portion with 4 to 5 chambers separated by indistinct, straight sutures; test composed of clear sand and black particles (mica ?) loosely cemented; exterior rough. Length of holotype (H. V. Howe Coll. No. 4216) 0.5 mm.; breadth of uniserial portion 0.15 mm.

This test has a "salt and pepper" appearance brought about by the

occurrence of black particles incorporated with the white quartz grain. It appears to be very similar to A. directus Cushman and Bronnimann except for the lack of lateral compression of the test.

This species occurs in the inland brackish environments. It has not been observed in the mudlump clay.

Genus FLABELLAMMINA Cushman, 1928

FLABELLAMMINA ADVENA Andersen, n. sp.

Plate I, figs. 12a, b

Test small, greatly compressed; early portion evolute coiled, chambers indistinct; uncoiled portion with chambers increasing in width and only slightly in height as added; about 5 to 6 chambers per whorl in coiled portion, 3 to 4 in uncoiled segment; sutures of uncoiled portion indistinct, arched upward toward aperture. Test extremely fragile, arenaceous material firmly united with a very thin layer of cement, exterior rough; aperture a long slit at the apex of the test. Length of holotype (H. V. Howe Coll. No. 4215) 0.51 mm.; width 0.50 mm.; thickness 0.15 mm.

There would be little doubt as to the generic identification of these specimens if they were found in Cretaceous sediments. The uniserial portion is extremely flat (not distorted) with acute angles and the sutures are strongly arched upward toward the apertural end. There appears to be nothing similar described from Recent sediments.

This species is rare and is found in the inner neritic sediment. It has not been observed in the mudlump clay.

Family TEXTULARIIDAE

Genus TEXTULARIA Defrance, 1824

TEXTULARIA BURRWOODENSIS Andersen, n. sp.

Plate II, figs. 2a, b

Test small, elongate, about four times as long as wide; chambers increasing gradually in size as added; initial end pointed; maximum width of test at last chamber; 9 to 11 pairs of chambers in adult test, distinct, inflated, last two practically globular; periphery broadly rounded, lobulate; sutures distinct and greatly depressed; wall composed of fine clear arenaceous material firmly united with thin cement, surface rough. The aperture is an arched opening at the base and inner margin of the last chamber. Length of holotype (H. V. Howe Coll. No. 4217) 0.35 mm.; breadth 0.10 mm.

This species is very similar to T. parvula Cushman based on 5 specimens taken from depths ranging from 227 to 821 fathoms. T. burrwoodensis n. sp. occurs in the inner neritic sediment (17 to 25 fathoms) and in some samples it may constitute as much as 1/5 the total foraminiferal assemblage present. Morphologically, T. burrwoodensis is smaller, has more inflated chambers and a much more fragile and chitinous wall than T. parvula.

TEXTULARIA CANDEIANA d'Orbigny

Plate I, figs. 13a, b

Textularia candeiana d'Orbigny, 1839, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminiferes," p. 143, pl. 1, figs. 25-27.

The very pronounced lip at the base and inner margin of the last formed chamber prevents these specimens from being absolutely typical

of those described by d'Orbigny from Cuba.

Length of hypotype (H. V. Howe Coll. No. 4218) 0.9 mm.; breadth 0.5 mm.

TEXTULARIA CLAVA Lalicker

Plate I, figs. 14a, b

Textularia clava Lalicker, 1935, Smithsonian Misc. Coll., vol. 91, no. 22, p. 1, figs. 1a-c.

Final chamber on figured specimen is slightly more inflated than the average of the hypodigm.

Length of hypotype (H. V. Howe Coll. No. 4219) 0.90 mm.; breadth 0.70 mm.

TEXTULARIA CONICA d'Orbigny

Plate I, figs. 18a, b

Textularia conica d'Orbigny, 1839, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminiferes," p. 143, pl. 1, figs. 19, 20.

Length of hypotype (H. V. Howe Coll. No. 4220) 0.72 mm.; breadth 0.85 mm.

TEXTULARIA CORRUGATA Heron-Allen and Earland

Plate I, figs. 15a, b

Textularia conica d'Orbigny, var. corrugata Heron-Allen and Earland, 1915, Trans. Zool. Soc., London, vol. 20, p. 629, pl. 47, figs. 24-27.

This is the T. corrugata of Cushman (Cushman Coll. No. 35170).

Length of hypotype (H. V. Howe Coll. No. 4221) 0.85 mm.; breadth 0.60 mm.

TEXTULARIA FOLIACEA OCCIDENTALIS Cushman

Plate I, figs. 17a, b

Textularia foliacea Heron-Allen var. occidentalis Cushman, 1922, U. S. Nat. Mus., Bull. 104, pt. 3, p. 16, pl. 2, fig. 13.

Typical specimens have a surface of finer agglutinated material than these. This hypodigm was compared with the holotype (U.S.N.M. Cat. No. 16991).

Length of hypotype (H. V. Howe Coll. No. 4222) 1.00 mm.; breadth 0.62 mm.; thickness 0.30 mm.

TEXTULARIA MAYORI Cushman

Plate I, figs. 20a, b

Textularia mayori Cushman, 1922, Carnegie Inst. Wash., vol. 17, p. 23, pl. 2, fig. 3.

The holotype was not available for study. The cotype examined proved conclusively that T. mayori Cushman is compressed, medium size and spinose.

Length of hypotype (H. V. Howe Coll. No. 4223) 0.75 mm.; breadth (excluding spiny projections) 0.6 mm.

TEXTULARIA MAYORI GIGANTA Andersen, n. var.

Plate I, figs. 21a, b

Test large, broadly triangular chambers increasing rapidly in size as added, greatest width of test at the apertural end; test rhomboid in cross section, thickness equal to approximately 3/4 the breadth of test (exclusive of spines), outer margin of the latter chambers with tubular projection which vary in length and diameter; sutures distinct and

slightly depressed on outer margin, indistinct along median line where there is a slight coating of arenaceous material; test finely arenaceous, surface fairly smooth. The aperture, a long narrow slit at the inner margin and base of last chamber, is located in a shallow embayment and has a very slight overhanging lip. Length of holotype (H. V. Howe Coll. No. 4224) 1.8 mm.; breadth 1.3 mm.; thickness 0.92 mm.

This variety is closely related to T. mayori Cushman. If they represent megalospheric and microspheric forms of the same species then both should be present when either is reported. T. mayori giganta is too distinct to be overlooked in a sample. Apparently it was not noted by Cushman in either the Tortugas collection or the Miocene of Florida. The relationship between T. mayori Cushman and T. mayori giganta n. var. needs additional study.

TEXTULARIA MEXICANA Cushman

Plate I, figs. 19a, b

Textularia mexicana Cushman, 1922, U. S. Nat. Mus., Bull. 104, pt. 3, p. 17, pl. 2, fig. 9.

Length of hypotype (H. V. Howe Coll. No. 4225) 1.00 mm.; breadth 0.8 mm.; thickness 0.55 mm.

TEXTULARIA SICA Lalicker and Bermudez

Plate I, figs. 16a, b

Textularia sica Lalicker and Bermudez, 1941, Torreia, no. 8, p. 16, pl. 4, figs. 5, 6.

Identification based on comparison with paratype, Cushman Coll. No. 35157.

Length of hypotype (H. V. Howe Coll. No. 4226) 1.0 mm.; breadth 0.45 mm.

TEXTULARIA sp. "A"

Plate II, figs. 1a, b

This is a spineless T. mayori Cushman. The rare occurrence of this form does not warrant an intensive study at this time.

Length of figured specimen (H. V. Howe Coll. No. 4227) 0.8 mm.; breadth 0.5 mm.

Genus SIPHOTEXTULARIA Finlay, 1939

SIPHOTEXTULARIA AFFINIS (Fornasini)

Plate II, figs. 3a, b

Sagrina affinis Fornasini, 1883, Boll. Soc. Geol. Itat., vol. II, p. 189, tav. II, figs. 6-12.

Fornasini illustrates the divergent but transitional forms which he has included in S. affinis. At one extreme in the hypodigm is the elongate, slightly compressed form with uniformly-sized chambers; the other extreme is a form in which the final chambers become greatly inflated. Both forms are present in the material examined, the latter in greater abundance.

Many specimens of authors described as Textularia catenata Cushman belong here.

Length of hypotype (H. V. Howe Coll. No. 4228) 0.60 mm.; breadth 0.40 mm.

SIPHOTEXTULARIA CONCAVA (Karrer)

Plate II, figs. 4a, b

Plecanium concava Karrer, 1868, Sitz, k. Ak. Wiss. Wien., vol. 58, Abth. 1, p. 129, pl. 1, fig. 3.

These specimens are currently being identified as S. concava although they are not absolutely typical of Karrer's type.

Length of hypotype (H. V. Howe Coll. No. 4229) 0.55 mm.; breadth 0.35 mm.

SIPHOTEXTULARIA MEXICANA Andersen, n. sp.

Plate II, figs. 5a, b

Test of medium size about twice as long as wide, compressed and twisted, the initial end and adult chamber lying in planes which approach but do not exceed 90° to each other; adult test with 8 to 10 pairs of chambers which increase in size gradually as added, the last pair of chambers making up about 1/3 of the total length of the test and the maximum breadth; periphery subacute; sutures distinct, slightly depressed and at a very acute angle to the median line; test of fine grained arenaceous material held together with large quantities of cement, surface smooth. The aperture is subterminal, rounded with a slight neck and lip. Length of holotype (H. V. Howe Coll. No. 4230) 0.9 mm.; breadth 0.50 mm.

The distinguishing features of this species are its subacute periphery, twisted test and broad final chambers. Some Gulf of Mexico-Carribean specimens of authors identified as Textularia subplana Cushman belong here.

Genus BIGENERINA d'Orbigny, 1826

BIGENERINA NODOSARIA TEXTULAROIDEA (Göes)

Plate II, figs. 8, 9a, b

Textularia sagittula Defrance, 1882, forma Bigenerina Göes, Kongl. Svensk. Vet. Akad. Handl., vol. 19, pt. 4, p. 78, pl. 5, figs. 159, 160.

Clavulina textularioidea Göes, 1894, Kongl. Svensk. Vet. Akad. Handl., vol. 25, p. 42, pl. 8, figs. 387, 399; 1896, Bull. Mus. Comp. Zool., vol. 29, p. 37, pl. 4, figs. 26, 38.

Judging from the figured specimens in the original description of B. nodosaria textularoidea (Göes), it would be very difficult to establish a rigid description for this variety. Any assignment to or exclusion from this group is arbitrary.

The writer has selected as the variety of B. nodosaria textularoidea those elongate forms with a relatively small biserial stage; a long uniserial stage in which the chambers are distinct and increase gradually in size as added; an apertural end which is slightly constricted but not with a distinct neck; and an aperture which may be simple or multiple (cribrate ?). No consideration is given the relative coarseness or fineness of the material used in the construction of the test. All forms which do not conform to these requirements are described as new varieties or species. Length of hypotype (H. V. Howe Coll. No. 4232) 3.0 mm.; maximum diameter 0.65 mm.; length of hypotype (H. V. Howe Coll. No. 4233) 2.5 mm.; maximum diameter 1.0 mm.

BIGENERINA NODOSARIA EXUDA Andersen, n. var.

Plate II, figs. 10a, b

Test large; biserial stage indistinct constituting less than 1/8 the total length of test; uniserial segment with 6 to 8 chambers of nearly uniform diameter and only slightly inflated; test of coarse agglutinated material with much cement, surface rough; sutures indistinct. The aperture consists of a group of irregular slit-like openings arranged in a roughly circular pattern in the flattened area at the apex of the test. Length of holotype (H. V. Howe Coll. No. 4231) 2.7 mm.; maximum diameter 0.9 mm.

This variety differs from B. nodosaria textularoidea in having larger, more uniform diameter chambers in the uniserial segment.

BIGENERINA SOUTHPASSENSIS Andersen, n. sp.

Plate II, fig. 6

Test of medium size; biserial portion, consisting of 3 to 4 pairs of chambers, is distinct and larger than the initial chambers of the uniserial section; uniserial segment in the microspheric form increase gradually in size as added; sutures distinct and depressed; wall of medium size agglutinated material (mainly sand particles) united with a clear cement, surface rough. The periphery of the uniserial portion is lobulate with the final chamber somewhat separated from rest of test. The aperture is a circular opening at the apex of a distinct neck. Length of holotype (H. V. Howe Coll. No. 4234) 1.20 mm.; maximum diameter 0.30 mm.

This species can be distinguished from B. nodosaria textularoidea by the more distinct biserial segment and the simple apertural opening

at the apex of the neck.

BIGENERINA SOUTHPASSENSIS XENULA Andersen, n. var.

Plate II, fig. 7

Test of medium size; biserial portion distinct, broadly triangular composed of 4 to 5 paired chambers, and occupying about 1/4 the total length of the test; uniserial segment with 4 to 5 loosely attached subglobose chambers of about the same dimension; suture distinct depressed; wall of coarse agglutinated materials with much cement, surface rough; aperture terminal, a circular opening at the apex of a distinct neck. Length of hypotype (H. V. Howe Coll. No. 4235) 1.3 mm.; maximum diameter 0.3 mm.

This variety can be distinguished from B. southpassensis n. sp. by the larger biserial stage, the widely separated chambers and the coarser agglutinated material in the test. It can be distinguished from B. nodosaria textularoidea by its simple aperture at the apex of a distinct neck, and the uniformity of chambers.

Family VERNEUILINIDAE

Genus PSEUDOCLAVULINA Cushman, 1936

PSEUDOCLAVULINA MEXICANA (Cushman)

Plate II, fig. 11

Clavulina humilis H. B. Brady, var. mexicana Cushman, 1922, U. S. Nat. Mus., Bull. 104, pt. 3, p. 83, pl. 16, figs. 1-3.

The separation of the final chamber from the preceeding is a characteristic of the P. mexicana in this material not shared with the paratype (U.S.N.M. Cat. No. 20063) with which these specimens were

compared.

Length of hypotype (H. V. Howe Coll. No. 4236) 2.6 mm.; maximum diameter 0.5 mm.

Genus GAUDRYINA d'Orbigny, 1839

GAUDRYINA (GAUDRYINA) SOUTHPASSENSIS Andersen, n. sp.

Plate II, figs. 12a, b

Test small; finely arenaceous, cement very prominent, surface smooth; chambers increasing in size rapidly in the early stages of development, adult with sides nearly parallel; triserial portion inconspicuous, consisting of 6 to 9 chambers; biserial segment with 6 to 8 pairs of chambers; sutures depressed at the margin of the test, limbate and slightly elevated along the median line. The aperture is a low, arched opening at the base and inner margin of the last formed chamber with slight overhanging lip. Length of holotype (H. V. Howe Coll. No. 4237) 0.5 mm.; breadth 0.25 mm.

This is a very small species characterized by its smooth surface, diminutive triserial stage and large number of chambers for size of test. There appears to be nothing similar described from the Gulf of Mexico-Carribean region.

Family VALVULINIDAE

Genus TEXTULARIELLA Cushman, 1927

TEXTULARIELLA BARRETTII (Jones and Parker)

Plate II, figs. 16a, b

Textularia barrettii Jones and Parker, 1863, Rep. British Association Newcastle Meeting, pp. 80-105.

Most of the specimens are typical of this species. Only a few are slightly compressed, but not sufficiently so to be assigned to the genus Cuneolina.

Length of hypotype (H. V. Howe Coll. No. 4241) 3.4 mm.; maximum breadth 2.8 mm.

Genus KARRERIELLA Cushman, 1933

KARRERIELLA BRADYI (Cushman)

Plate II, figs. 13a, b and 14

Gaudryina pupoides H. B. Brady (not d'Orbigny), 1894, Rep. Voy. Challenger, Zool., vol. 9, p. 378, pl. 46, figs. 1-4.

These specimens have a slightly less inflated final chamber than the holotype (U.S.N.M. Cat. No. 26307), but appear to be similar to subsequent plesiotypes designated by Cushman.

Length of hypotypes (H. V. Howe Coll. Nos. 4238 and 4239) 0.8 mm.; maximum diameter 0.34 mm.

Genus DOROTHIA Plummer, 1931

DOROTHIA CARIBAEA Cushman

Plate II, figs. 15a, b

Dorothia caribaea Cushman, 1936, Contr. Cushman Lab. Foram. Res., p. 31, pl. 5, fig. 3.

Specimens assigned to this species are slightly smaller than the holotype (Cushman Coll. No. 20909).

Length of hypotype (H. V. Howe Coll. No. 4240) 1.5 mm.; maximum diameter 0.6 mm.

Genus LIEBUSELLA Cushman, 1933

LIEBUSELLA SOLDANII (Jones and Parker)

Plate II, fig. 17

Lituola soldanii Jones and Parker, 1860, Quart. Journ. Geol. Soc., vol. 16, p. 307, no. 184.

Palmer (1945) considers L. soldanii intermedia the microspheric form of L. soldanii.

Length of hypotype (H. V. Howe Coll. No. 4242) 4.0 mm.; breadth 1.5 mm.

Genus AMMOBULIMINA Andersen, n. gen.

Genotype Ammobulimina mexicana Andersen, n. sp.

Test free, arenaceous; initial chambers multiserial, rapidly reducing to three chambers, and in some adult forms tending to become biserial; aperture a "comma-shaped" opening at the base and inner margin of the last chamber.

This genus lacks the distinct biserial stage and aperture of Dorothia; the completely triserial and triangular form of Verneuilina; and the spiral chamber arrangement and broad rounded tooth of Arenobulimina. It is best described as an arenaceous Bulimina which is more typical of its calcareous perforate counterpart than Arenobulimina.

AMMOBULIMINA MEXICANA Andersen, n. sp.

Plate II, figs. 18a, b

Test small; wall of medium sized sand grains loosely cemented, surface rough; initial multiocular stage very small, and rapidly reducing to a distinct triserial arrangement, with the last two chambers at approximately 180 degrees; chambers subglobular; sutures distinct, depressed; aperture simple, a loop-shaped opening at the base and inner margin of the last chamber. Length of holotype (H. V. Howe Coll. No. 4243) 0.50 mm.; maximum breadth 0.30 mm.

This species occurs in the inner neritic zone. It has not been found in the mudlump clay.

Family MILIOLIDAE

Genus QUINQUELOCULINA d'Orbigny

QUINQUELOCULINA cf. BICOSTATA d'Orbigny

Plate III, figs. 7a-c

Quinqueloculina bicostata d'Orbigny, 1839, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminiferes", p. 195, pl. 12, figs. 8-10.

These specimens appear to be the same as d'Orbigny described from Cuba.

Length of figured specimen (H. V. Howe Coll. No. 4244) 1.2 mm.; maximum breadth 0.9 mm.

QUINQUELOCULINA BURRWOODENSIS Andersen, n. sp.

Plate III, figs. 3a-c

Test small; about twice as long as wide; basal end round; outer portion of apertural end slightly projected above the previous chamber and curved outward, inner portion terminates at the point of intersection with the previous chamber; chambers distinct, somewhat inflated; periphery round; wall semi-transparent with high gloss, surface smooth; aperture a semi-circular opening at the end of last chamber with a long, narrow bifid tooth which extends across the entire inner margin of the last chamber. Length of holotype (H. V. Howe Coll. No. 4245) 0.6 mm.; maximum breadth 0.25 mm.

This species is very similar to what is currently referred to as Q. seminula (Linne). Although there is little consistency in the characteristics of specimens assigned to Q. seminula, the species described herein as new appears to be much smaller, has more parallel sides and a much larger tooth in the aperture than the Q. seminula of many authors.

QUINQUELOCULINA CANDEIANA d'Orbigny

Plate III, figs. 1a-c

Quinqueloculina candeiana d'Orbigny, 1839, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminiferes", p. 199, pl. 12, figs. 24-26.

These specimens appear to be quite typical of the Cuban forms.

Length of hypotype (H. V. Howe Coll. No. 4246) 0.82 mm.; maximum breadth 0.40 mm.

QUINQUELOCULINA cf. GLABRATA Cushman

Plate III, figs. 2a-c

Quinqueloculina glabrata Cushman, 1922, U. S. Geol. Surv., Prof. Paper 129-F, p. 141, pl. 34, fig. 8.

This is a Q. candeiana d'Orbigny in which the acute peripheral angles of the chambers are concealed. The net result of this slight change in the manner of adding chambers produces a test which is roughly triangular with flattened sides.

Length of figured specimen (H. V. Howe Coll. No. 4237) 0.70 mm.; breadth 0.35 mm.

QUINQUELOCULINA cf. LAMARCKIANA d'Orbigny

Plate III, figs. 5a-c and 6a-c

Quinqueloculina lamarckiana d'Orbigny, 1839, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminiferes", p. 189, pl. 11, figs. 14, 15.

Quinqueloculina auberiana d'Orbigny, 1839, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminiferes", p. 193, pl. 12, figs. 1, 3.

Three species of Quinqueloculina described from the West Indian region are very closely related. Cushman has placed two species, Q. auberiana and Q. lamarckiana, in synonymy; the third, Q. cuvieriana, was evidently considered to be different from the other two, and thus a valid species.

The writer has insufficient material from the West Indian region to evaluate previous work. However, the specimens present in the material examined from the coast of Louisiana indicate that either all three forms should be placed in synonymy or an attempt should be made to reinterpret d'Orbigny's descriptions.

The following literal translations of d'Orbigny's comments regarding the relationship between these species will clarify the confused status of the writer's specimens:

> Q. auberiana — "In 1825 we confused this species with Q. vulgaris of the Mediterranean, a species to which it is very closely related in its external shape (undulations, etc.), but after a more careful study thereof we had to separate the two since Q. auberiana always has a simple tooth in the aperture instead of a bifid tooth. It (Q. auberiana) is also related to Q. lamarckiana but differs from it by the transverse undulations which Q. auberiana always has."
>
> Q. cuvieriana — "This species is very similar to Q. lamarckiana by its stubby shape and its sharp keel; it differs from Q. lamarckiana by its truncated chamber which does not go forward (?), by its sharper keel which is accomplished by longitudinal striae and by its more elongate aperture."
>
> Q. lamarckiana — "By its wide and inflated shape, it is related both to Q. vulgaris of the Mediterranean and to Q. cuveriana from the Antilles. It differs from Q. vulgaris only by its more keeled chambers and by its aperture with a simple, instead of a bifid tooth; it differs from Q. cuvieriana by the absence of striae near the keel, by the anterior projection of the last chamber, and by its less elongated aperture."

The specimens herein referred to Q. lamarckiana combine some of the characteristics of all three species described above. Young specimens (figs. 5a-c) have longitudinal costae on the subacute periphery of each chamber; the adult forms have smooth, sharply-keeled chambers. This transition can be noted on the specimen in figure 6a-c.

Length of figured specimens (H. V. Howe Coll. No. 4248) 0.95 mm.; breadth 0.70 mm.; (H. V. Howe Coll. No. 4249) 1.00 mm.; breadth 0.90 mm.

QUINQUELOCULINA PORTEADSENSIS Andersen, n. sp.

Plate III, figs. 4a-c

Test small; less than twice as long as broad, basal end rounded projecting slightly beyond the previous chamber, aperture end continues into a short neck with a thickened, everted lip; chambers distinct, subquadrate in cross section with a carinate ridge on each angle of the chamber at the aboral end which converge to form a single carena in the center of the chamber at the oral end; sides of the chamber flat, sutures distinct; wall composed of a lusterless cement material which gives the wall a false appearance of being finely arenaceous, surface rough, irregularly pitted. The aperture, located at the apex of a short neck, has a broad bifid tooth at its inner margin which occupies about half the apertural opening. Length of holotype (H. V. Howe Coll. No. 4250) 0.60 mm.; maximum breadth 0.40 mm.

This is a very distinct species which appears to have been overlooked in previous Gulf of Mexico assemblages. Specimens from the Tortugas, Florida, in Cushman's collection have been referred to two species, Q. polygona d'Orbigny and Q. bidentata d'Orbigny. Q. polygona is a more elongate form than Q. porteadsensis n. sp.; Q. bidentata is arenaceous.

QUINQUELOCULINA SABULOSA Cushman

Plate II, figs. 20a-c

Quinqueloculina sabulosa Cushman, 1947, Contr. Cushman Lab. Foram. Res., vol. 23, pt. 4, p. 87, pl. 18, fig. 22.

Chambers of holotype (Cushman Coll. No. 49034) are slightly more acute than the specimens in this collection.

Length of hypotype (H. V. Howe Coll. No. 4251) 0.55 mm.; maximum breadth 0.38 mm.

QUINQUELOCULINA sp. "A"

Plate II, figs. 19a-c

Test small, less than twice as long as broad; basal end rounded, apertural end very slightly produced above preceeding chamber; chambers distinct, somewhat inflated, periphery round; sutures fairly distinct, slightly depressed; wall coarsely arenaceous, poorly cemented, surface rough; aperture, a circular opening at the apex of a very slight neck, is filled with porous cement material. Length of figured specimen (H. V. Howe Coll. No. 4252) 0.4 mm.; maximum breadth 0.21 mm.

The description of this species is based on 3 specimens from the inland brackish sediments. A hypodigm this small will not insure a persistency in the characteristics indicated, particularly such a distinctive feature as the apertural filling. In the material studied, this species can be distinguished from Q. sabulosa by its smaller size, more rounded chambers and cribrate (?) aperture.

QUINQUELOCULINA sp. "B"

Plate III, figs. 8a-c

Test large, breadth nearly equal to the length; basal end rounded, the last chamber extending beyond the outline of the test; apertural end produced into a short, distinct neck; chambers distinct, matte, periphery flattened and bearing three elevated ridges, sides of chambers excavated; sutures distinct. The aperture, located at the apex of the short neck, bears a large bifid tooth at its inner margin. Length of figured specimen (H. V. Howe Coll. No. 4253) 1.9 mm.; maximum breadth 1.5 mm.

Only the large adult specimens bear heavy ridges on the periphery. Young specimens have a truncated and smooth periphery or only faint indications of the tri-costate ornamentation so pronounced in latter stages of development.

This species is somewhat similar to Q. gigas Natland described from the California coast except that it does not carry fine costae on the heavy ribs. Q. pulchella d'Orbigny is more coarsely and irregularly costate, particularly along the sides of the chambers.

Genus MILIOLINELLA Wiesner, 1931

MILIOLINELLA cf. CALIFORNICA Rhumbler

Plate III, figs. 11a-c

Triloculina circularis Cushman and Valentine (not Bornemann), 1930, Contrib. Dept. Geol. Stanford Univ., vol. 1, p. 15, t. 4, figs. 4a-c.

Miliolinella californica Rhumbler, 1936, Foraminiferen der Kieler Bucht, gesamelt durch A. Remane; Tiel II, Ammodisculinidae bis einscht. Textulinidae, Kiel. Meeresf, Kiel, Detuschland, Bd. 1 (1936-1937),

Heft 1, p. 215.

It is remotely possible that the Gulf of Mexico-Carribean group of Miliolids herein referred to Miliolinella californica Rhumbler are slightly different than the Cushman and Valentine specimen used by Rhumbler to establish this species. The test of the writer's specimens is much more oblong than M. californica and the aperture in the adult form is a very thin slit-like opening between the outer margin of the last chamber and the flattened tooth which extends down farther on one side of the test than on the other.

Length of figured specimen (H. V. Howe Coll. No. 4256) 0.80 mm.; maximum breadth 0.80 mm.

MILIOLINELLA PORTEAUSENSIS Andersen, n. sp.

Plate III, figs. 10a-c

Test of medium size, elongate, oval outline; triloculine chamber arrangement; basal end of test broadly rounded, apertural chamber slightly truncated, and about the same length as the previous chamber; chambers rounded in cross section, distinct; wall smooth, polished and semi-translucent; the aperture is a crescent-shaped slit which lies between the outer margin of the final chamber and a large, excavated tooth. Length of holotype (H. V. Howe Coll. No. 4255) 0.74 mm.; maximum breadth 0.30 mm.

This species is easy to recognize by its smooth oval outline and the large tooth which has a deeply excavated center. Although the illustrations are not too clear, this may be the same species described by Flint, 1897, (pl. 43, fig. 3) as Miliolina oblonga (Montagu).

Genus MASSILINA Schlumberger, 1893

MASSILINA SOUTHPASSENSIS Andersen, n. sp.

Plate III, figs. 9a-c

Test large, elongate, adult specimens with sides flattened, 3 chambers visible on each side of the test; basal end of last chamber projected slightly beyond the outline of the test, apertural end extended into a distinct elongate neck; sutures distinct; wall dull, surface with numerous fine linear depressions; chambers of young specimens broad and flat, acute at the periphery, and coiled in a quinqueloculine manner; chambers of the adult specimens have a truncated to depressed periphery and flat parallel sides. The aperture, located at the apex of a slight neck, is an elongate, triangular-shaped opening with a bifid tooth which connects with one side of the test wall at the inner margin. Length of holotype (H. V. Howe Coll. No. 4254) 1.35 mm.; maximum breadth 0.90 mm.; thickness 0.25 mm.

The characteristic feature of this species, which has been used to identify the young forms so dissimilar to the adults, is the unusual arrangement of the tooth in the aperture. There is always a gap at the inner margin of the test between one wall of the chamber and the tooth. The opposite wall appears to make an acute 180 degree turn into the apertural opening at its inner margin to form the long bifid tooth.

In external appearance, this specimen is similar to M. inaequalis Cushman from the north coast of Jamaica. The unique tooth of M. southpassensis n. sp. described above is sufficient to distinguish between the two species.

Genus SPIROLOCULINA d'Orbigny, 1826

SPIROLOCULINA cf. ANTILLARIUM d'Orbigny

Plate IV, figs. 3a, b

Spiroloculina antillarium d'Orbigny, 1839, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminiferes", p. 137, pl. 12, fig. 7.

Plesiotypes from the Tortugas, Florida, area in Cushman's collection, considered to be typical of d'Orbigny's species described from Cuba, do not have the loose manner of coiling which is characteristic of the specimens from the mudlump clay. Since the species is considered to be inconsistent in the amount and intensity of the costate ornamentation, it probably follows that there is also an inconsistency in the manner of coiling. Length of figured specimen (H. V. Howe Coll. No. 4257) 0.80 mm.; maximum breadth 0.40 mm.; thickness 0.15 mm.

SPIROLOCULINA SOUTHPASSENSIS Andersen, n. sp.

Plate IV, figs. 1a, b

Test slightly longer than broad, periphery truncate to concave with carinate margins; 10 to 14 chambers in the test increasing in size as added; sides moderately convex in microspheric forms, deeply depressed in megalospheric forms; sutures slightly depressed, margins of test flush with the surface; basal end rounded and projecting beyond the outline of the test; apertural end recurved, inner margin flush with previous coil; wall opaque, surface with fine, irregular linear depressions; aperture at open end of last chamber, nearly quadrate, (inner margin slightly narrower than outer) with long, simple tooth. Length of holotype (H. V. Howe Coll. No. 4258) 0.9 mm.; breadth 0.8 mm.; thickness 0.3 mm.

This can be distinguished from S. atlantica Cushman and S. norvegica Cushman and Todd by the flattened to concave periphery and from S. toddae Bermudez by its quadrate aperture. The only distinction between this species and S. soldanii Fornasini appears to be the raised ridges of the early chambers present in the latter but not conspicuous in this new species, S. southpassensis.

SPIROLOCULINA sp. "A"

Plate IV, figs. 2a, b

A single large, compressed specimen with a circular outline could be a mutation of S. southpassensis n. sp.

Length of figured specimen (H. V. Howe Coll. No. 4259) 1.0 mm.; maximum breadth 0.9 mm.; thickness 0.18 mm.

Genus SIGMOILINA Schlumberger, 1887

SIGMOILINA cf. FLINTII Cushman

Plate IV, figs. 6a, b

Spiroloculina arenaria Flint (not H. B. Brady), 1897 (1899), Ann. Rep. U. S. Nat. Mus., pt. 1, p. 297, pl. 43, fig. 1.

Sigmoilina flintii Cushman, 1946, Contr. Cushman Lab. Foram. Res., vol. 22, pt. 2, p. 44, pl. 6, figs. 35-39.

The specimens in this assemblage are larger, have a slightly longer neck, and a larger area surrounding the neck where the calcareous imperforate base is exposed than the holotype (Cushman Coll. No. 46239). The aperture bears a small bifid tooth which was not mentioned by Cushman but is reported by Flint.

Length of figured specimen (H. V. Howe Coll. No. 4260) 1.5 mm.;

maximum breadth 1.10 mm.; thickness 0.50 mm.

SIGMOILINA SCHLUMBERGERI A. Silvestri

Plate IV, figs. 7a, b

Sigmoilina schlumbergeri A. Silvestri, 1904, Mem. Pont. Accad. Nuovi. Lincei., vol. 22, p. 267.

This group of specimens with a fine arenaceous coating and indistinct chamber arrangement appear to satisfy the requirements of S. schlumbergeri.

Length of hypotype (H. V. Howe Coll. No. 4261) 1.0 mm.; maximum breadth 0.7 mm.

SIGMOILINA TENUIS (Czjzek)

Plate IV, figs. 4a, b and 5

Quinqueloculina tenuis Czjzek, 1847, Haidinger's Nat. Abhandl., vol. 2, p. 149, pl. 13, figs. 31-34.

Figure 5 is representative of a rare group of specimens in the material examined which are similar to topotypes of S. tenuis (Czjzek) from Baden, Vienna Basin, Austria (Cushman Coll. No. 10620). The majority of the specimens are like fig. 6, a form which is somewhat smaller and with a very pronounced lateral warp to the chambers in the central portion of the test.

Length of hypotypes (H. V. Howe Coll. No. 4262) 0.32 mm.; maximum breadth 0.18 mm.; (H. V. Howe Coll. No. 4263) 0.40 mm.; breadth 0.20 mm.

Genus ARTICULINA d'Orbigny, 1826

ARTICULINA MAYORI Cushman

Plate IV, figs. 9, 10

Articulina mayori Cushman, 1922, Publ. No. 311, Carnegie Inst., p. 71, pl. 13, fig. 5.

In both the megalospheric and microspheric forms, the costae are confined to the outer portion of the chamber near the everted lip, and are less distinct than the holotype (Cushman Coll. No. 4372).

Length of megalospheric form (H. V. Howe Coll. No. 4264) 0.9 mm. Length of microspheric form (H. V. Howe Coll. No. 4265) 0.8 mm.

ARTICULINA cf. MUCRONATA (d'Orbigny)

Plate IV, figs. 8a, b

Vertebralina mucronata d'Orbigny, 1839, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminiferes", p. 52, pl. 7, figs. 16-19.

This is a very questionable assignment. There is no uniserial stage in any of the specimens in the assemblage and the periphery of each chamber is more acute than any A. mucronata examined.

This may be the same as A. cibaeoensis Bermudez described from the Lower Miocene of the Dominican Republic.

Length of figured specimen (H. V. Howe Coll. No. 4266) 0.35 mm.; maximum breadth 0.20 mm.

Genus TRILOCULINA d'Orbigny, 1826

TRILOCULINA INSIGNIS (H. B. Brady)

Plate IV, figs. 13 and 14a-c

Miliolina insignis H. B. Brady, 1884, "Challenger", Zool., vol. 9, p. 165, pl. 4, figs. 8, 10.

These specimens appear to be typical of the T. insignis described by H. B. Brady, the greatest dissimilarity noted being the rare occurrence of a large, centrally perforated apertural tooth like the one shown in fig. 13.

Length of hypotypes (H. V. Howe Coll. No. 4267) 1.10 mm.; maximum breadth 1.05 mm.; (H. V. Howe Coll. No. 4268) 1.40 mm.; maximum breadth 1.35 mm.

TRILOCULINA cf. STRIATOTRIGONULA Parker and Jones

Plate IV, figs. 11a-c

(Miliola) (Triloculina) striato-trigonula Parker and Jones, 1865, Phil. Trans. Roy. Soc., vol. 155, p. 438 (nomen nudum).

Miliola insignis H. B. Brady, -H. B. Brady, 1884 (part), Rept. Voy. Challenger, Zool., vol. 9, pl. 4, fig. 10 (non fig. 8).

Triloculina striatotrigonula, Parr, 1941, Mining and Geol. Journ., vol. 2, no. 5, p. 305.

A single specimen in this collection is tentatively referred to T. striatotrigonula. It has the same chamber arrangement as Brady's species from the shallow water of the south coast of Australia, but lacks the thin bifid tooth.

Length of figured specimen (H. V. Howe Coll. No. 4271) 0.40 mm.; maximum breadth 0.32 mm.

TRILOCULINA TRICARINATA d'Orbigny

Plate IV, figs. 12a-c

Triloculina tricarinata d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 299, no. 7; Modeles, 1826, no. 94.

Typical of the specimens currently being assigned to T. tricarinata d'Orbigny.

Length of hypotype (H. V. Howe Coll. No. 4269) 0.80 mm.; maximum breadth 0.70 mm.

TRILOCULINA TRIGONULA (Lamarck)

Plate IV, figs. 15a-c

Miliola trigonula Lamarck, 1804, Ann. Mus., vol. 5, p. 351, no. 3; vol. 9, 1807, pl. 17, fig. 4.

These are slightly more inflated than the Eocene specimens from Hauteville, France, but are typical of the West Indian region specimens identified as T. trigonula.

Length of hypotype (H. V. Howe Coll. No. 4270) 0.81 mm.; maximum breadth 0.78 mm.

Genus PYRGO Defrance, 1824

PYRGO cf. CARINATA (d'Orbigny)

Plate V, figs. 2a-c

Biloculina carinata d'Orbigny, 1839, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminiferes", p. 164, vol. 8, pl. 8, fig. 24; pl. 9, figs. 1, 2.

The name most commonly used by Cushman in identifying this species is P. denticulata H. B. Brady, which was reported from Honolulu, Friendly

Islands and Admiralty Islands. In order to use Brady's species, it was necessary to assume that many forms do not have the denticulate margin at the aboral end of the test. For those Gulf of Mexico-Carribean specimens reported in U. S. Nat. Mus., Bull. 104, it would have been more tenable to use P. carinata (d'Orbigny) described from Cuba and St. Thomas by simply postulating that d'Orbigny's species at times might have a slight denticulate margin at the base of the test.

Length of figured specimen (H. V. Howe Coll. No. 4272) 1.00 mm.; maximum breadth 0.80 mm.

PYRGO cf. ELONGATA (d'Orbigny)

Plate V, figs. 1a-c

Biloculina elongata d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 296, no. 4,

These specimens are tentatively referred to P. elongata (d'Orbigny) on the basis of current use.

Length of figured specimen (H. V. Howe Coll. No. 4276) 0.90 mm.; maximum breadth 0.70 mm.

PYRGO NASUTUS Cushman

Plate IV, figs. 17a-c

Pyrgo nasutus Cushman, 1935, Smithsonian Inst. Misc. Coll., vol. 91, no. 21, p. 7, pl. 3, figs. 1-4.

Compared with holotype (Cushman Coll. No. 26200).

Length of hypotype (H. V. Howe Coll. No. 4273) 0.60 mm.; maximum breadth 0.50 mm.

PYRGO NASUTUS BALIZENSIS, Andersen, n. var.

Plate IV, figs. 19a-c

This variety differs from the typical form in its rounded, smooth outline, and extreme and nearly equal convexity of the two chambers. It differs from P. nasutus southpassensis in its greater thickness and lack of a neck which protrudes above the outline of the test. Length of holotype (H. V. Howe Coll. No. 4274) 0.65 mm.; breadth 0.62 mm.

PYRGO NASUTUS SOUTHPASSENSIS Andersen, n. var.

Plate IV, figs. 18a-c

Variety differing from the typical form in having a greater thickness and a smooth periphery. Length of holotype (H. V. Howe Coll. No. 4275) 0.75 mm.; maximum breadth 0.70 mm.

PYRGO SUBSPHAERICA BURRWOODENSIS Andersen, n. var.

Plate V, figs. 3a-c

This differs from the typical P. subsphaerica (d'Orbigny) in having faint, broad longitudinal costae.

This variety is much smaller, has less deeply incised costae, and a much smaller tooth than P. comata H. B. Brady.

Length of holotype (H. V. Howe Coll. No. 4277) 0.60 mm.; maximum breadth 0.59 mm.

PYRGO VESPERTILIO (Schlumberger)

Plate V, figs. 4a, b

Biloculina ringens Lamarck. -Brady (part), 1884, Chall. Rept., p. 142, pl. 2, fig. 8.

Length of hypotype (H. V. Howe Coll. No. 4278) 1.80 mm.; maximum breadth 1.9 mm.

PYRGO sp. "A"

Plate IV, figs. 16a-c

A few small specimens ornamented with 8 to 10 large costae apparently represent a new species but are too rare in the present material to be described.

Length of figured specimen (H. V. Howe Coll. No. 4279) 0.50 mm.; maximum breadth 0.48 mm.

Genus PYRGOELLA Cushman and White, 1936

PYRGOELLA SPHAERA (d'Orbigny)

Plate V, figs. 5a, b

Biloculina sphaera d'Orbigny, 1839, Voyage dans l'Amerique Meridionale; Foraminiferes, tome 5, pt. 5, p. 66, pl. 8, figs. 13-16.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4280) 0.98 mm.

Genus BILOCULINELLA Wiesner, 1931

BILOCULINELLA ? sp. "A"

Plate V, fig. 6

This small specimen has been described by Cushman as Biloculina irregularis (U.S.N.M. Cat. No. 15770A). This assignment is questionable since many develop a Y-shaped aperture similar to Pyrgoella.

Maximum diameter of figured specimen (H. V. Howe Coll. No. 4281) 0.35 mm.

BILOCULINELLA LABIATA (Schlumberger)

Plate V, figs. 7a-c

Biloculina labiata Schlumberger, 1891, Soc. Zool. tome 4, p. 556, pl. 9, figs. 60-62.

A single specimen in the collection appears to belong to this species.

Length of hypotype (H. V. Howe Coll. No. 4282) 0.38 mm.; maximum breadth 0.3 mm.

BILOCULINELLA TODDAE Andersen, n. name

Plate V, figs. 8a, b

Biloculinella globula Cushman and Valentine (not Bornemann), Foraminifera their classification and economic use, 4th ed. 1948, key pl. 15, fig. 11.

Test of medium size, rotund, chambers inflated; length slightly greater than the width; suture indistinct; final chamber greatly embracing the previous chamber; surface of test smooth, glossy; aperture a circular opening covered by a broad, flat tooth. Length of holotype

(H. V. Howe Coll. No. 4263) 0.62 mm.; breadth 0.52 mm.

Bornemann's specimen has an excavated spot in the flat triangular shaped tooth which is not present in the Biloculinella globula of Cushman and Valentine.

This species is named in honor of Miss Ruth Todd who brought this nomenclatural descrepancy to the writer's attention.

Family OPTHALMIDIIAE

Genus CORNUSPIRA Schultz, 1854

CORNUSPIRA PLANORBIS Schultz

Plate V, fig. 10

?Operculina incerta d'Orbigny, 1839, Foraminifera de l'ile de Cuba, p. 49, tab. VI, figs. 16, 17.

Cornuspira planorbis Schultz, 1854, Englemann, p. 40, pl. 2, fig. 21.

This small, transparent form is currently being assigned to C. planorbis Schultz.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4285) 0.28 mm.

Genus CORNUSPIROIDES Cushman, 1928

CORNUSPIROIDES FOLIACEUM (Philippi)

Plate V, fig. 11

Orbis foliaceus Philippi, 1844, Enm. Moll. Siciliae, vol. 2, p. 147, pl. 24, fig. 26.

Cornuspiroides foliaceum (Philippi). -Bermudez, 1949, Cushman Lab. Foram. Res., Spec. Publ. 25, p. 113, pl. 6, figs. 42, 49.

Length of hypotype (H. V. Howe Coll. No. 4286) 3.8 mm.; maximum breadth 2.5 mm.

Genus SPIROPHTHALMIDIUM Cushman, 1927

SPIROPHTHALMIDIUM sp. "A"

Plate V, fig. 9

A single specimen can be referred to this genus. It is probably fig. 15 of the group of dissimilar specimens identified by Brady as Spiroloculina acutimargo (Challenger Rept., vol. 9, 1884, pl. 10, figs. 12-15). Figure 13 was selected by Cushman as the genotype for the genus Spirophthalmidium. Figure 15 with loosely coiled chambers and a long neck which this specimen resembles probably could be described as new.

Length of figured specimen (H. V. Howe Coll. No. 4284) 0.35 mm.; maximum breadth 0.12 mm.

Genus NODOBACULARIELLA Cushman and Hanzawa, 1937

NODOBACULARIELLA ATLANTICA Cushman and Hanzawa

Plate V, fig. 12

Vertebralina insignis Brady, Flint, 1897 (1899), Ann. Rept. U. S. Nat. Mus., p. 302, pl. 47, fig. 4.

The specimens figured by Flint from the Gulf of Mexico are more typical of those in this assemblage than Cushman's holotype from the northern Atlantic.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4287) 1.50 mm.; minimum diameter 1.30 mm.

NODOBACULARIELLA sp. "A"

Plate V, figs. 13a, b

This species has the same general appearance as N. convexiuscaula (H. B. Brady) but differs in being less costate and having a less elevated and thickened lip. It probably should be tentatively referred to Brady's species.

Length of figured specimen (H. V. Howe Coll. No. 4288) 0.70 mm.; maximum breadth 0.4 mm.

Family TROCHAMMINIDAE

Genus TROCHAMMINA Parker and Jones, 1859

TROCHAMMINA INFLATA (Montagu)

Plate V, figs. 15a-c

Nautilus inflatus Montagu, 1808, Test. Brit., Suppl., p. 81, pl. 18, fig. 3.

This is a common species in the inner neritic zones.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4289) 0.53 mm.; thickness 0.30 mm.

TROCHAMMINA cf. ROTALIFORMIS J. Wright

Plate V, figs. 16a-c

Trochammina inflata (Montagu) var. Blackwell and Wright, Trans. Roy. Irish Acad., vol. 28, (Science) 1885, p. 331, pl. 31, figs. 11, 12.

Trochammina rotaliformis J. Wright, 1911, in Heron-Allen and Earland, Journ. Roy. Micr. Soc., p. 309.

A few specimens from the inner neritic and tidal stream sediments are tentatively identified as T. rotaliformis.

Maximum diameter of figured specimen (H. V. Howe Coll. No. 4290) 0.60 mm.; thickness 0.20 mm.

Genus ARENOPARRELLA Andersen, n. gen.

Genotype Trochammina inflata (Montagu) var. mexicana Kornfeld

Test free, trochoid, umbilical area closed and depressed, dorsal side convex; wall finely arenaceous; aperture a slit-like opening with long axis oriented approximately parallel to the plane of coiling, either open at the base or separated from the preceeding volution by a thin everted lip.

The major difference between this genus and the closely related Trochammina lies in the shape and position of the aperture. Trochammina encompasses those trochiform test in which the aperture is a slit or arched opening at the ventral inner margin of the last formed chamber; Arenoparrella those trochiform tests in which the aperture is an elongate slit roughly parallel to the periphery.

ARENOPARRELLA MEXICANA (Kornfeld)

Plate V, figs. 14a-c

Trochammina inflata (Montagu) var. mexicana Kornfeld, 1931, Contr. Stanford Geol. Dept., vol. 1, p. 86, pl. 13, figs. 5a-c.

Test trochoid, dorsal side moderately convex, ventral side with a depressed, closed umbilicus; periphery bluntly acute, lobulate in adult specimens. Chambers typically five to each whorl, slightly inflated on dorsal side, ventral side with pronounced inflation of chambers near the umbilicus; sutures distinct, slightly curved on dorsal side, radial and straight on ventral side. The aperture is a curved, almost angular slit

in the apertural face of the last chamber, the inner portion of the curve extending from the periphery ventrally at an angle of 30 to 40 degrees with the plane of coiling, the outer portion of the curve oriented almost parallel to the plane of coiling. The aperture is surrounded by a thin, delicate everted lip which in some specimens continues across the base of the aperture thus separating the aperture from the preceeding volution. A chitin proloculum is visible at the apex of the dorsal spire; the adult portion of the test is composed of approximately equal amounts of yellowish-brown cement and fine grained arenaceous material.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4200) 0.46 mm.; maximum thickness 0.18 mm.

Family LAGINIDAE

Genus ROBULUS Montfort, 1808

Genotype Robulus cultratus Montfort

The genus Robulus as delineated herein, includes those planispirally coiled, bilaterally symmetrical Lagenids with a triangular or elongate slit-like apertural opening in the central, outer margin of the final chamber. This is a feature often referred to as the "median slit" or "robuline aperture". No attempt has been made to eliminate from this group those forms with a semi-cribrate apertural filling which could be assigned to the genus Cribrorobulina erected by Selli.

The validity of the genus Robulus is in question. Cushman has intimated that it might be desirable to substitute Lenticulina for Robulus since it is difficult to separate the two. Marie (1941) has unequivocally placed Robulus in the synonymy of Lenticulina. It would be desirable to follow Marie in assigning the name Lenticulina to the

planispirally coiled forms, but this simple solution can be affected only after additional information has been obtained regarding Marie's work with the Defrance Collection.

The writer has not been too concerned about this generic controversy since the use of either Robulus or Lenticulina, or for that matter both names would be of no assistance in solving the mystery of the robuline species. Apparently some authors have solved this enigma, but the writer found himself at a complete loss in assigning specific names to many species in the large assemblage present in the material being studied. Little difficulty was experienced with the distinctively ornamented Robulus. The big problem lay in the unornamented specimens where the only means of identification in current literature is based on number of chambers, limbosity and curvature of sutures, presence or absence of keel, umbilical plug, etc. These characters are not valueless, but they are not always persistent throughout all stages of development of the individual.

The method used by the writer to classify the nondescript species of Robulus was inspired by Wedekind's division of the "Nodosarioidae" on the basis of the aperture. Trial separations based on the apertural pattern (with only minor consideration being given to the other morphologic features of the test) resulted in such a homogeneous grouping of the assemblage that this technique was persued to the end. The proof of the writer's thesis, that the architecture of the Robulus aperture is a very important factor in identifying the different species, lies in the study of robuline assemblages from widely separated areas. This, by necessity, must be postponed until some later date.

ROBULUS BALIZENSIS Andersen, n. sp.

Plate VI, figs. 1a, b

Test small, biconvex; typically with 6 chambers in the last formed whorl, occassionally 7; periphery acute with narrow keel; very small clear spot in the umbilicus; sutures curved and limbate but not raised above the surface of the test; apertural face small, depressed, and flat.

The aperture, elongate with plane of coiling, consists of two non-radiate, plate-like processes which project above the periphery of the test. The keel passes between the plates in the posterior portion of the aperture, and becomes united with both plates near the center of the aperture at the outer margin of the median slit. These plates continue forward into the apertural face where they form fin-like projections which flank the median slit. Each plate usually has two small, vertical slit-like openings at the apex of the aperture. Holotype (H. V. Howe Coll. No. 4291) 1.0 in maximum diameter; 0.45 mm. in thickness.

There is nothing really distinctive about this species except the nature of the aperture which remains rather consistent in the characteristics described.

ROBULUS BOWDENENSIS (Cushman)

Plate VI, figs. 10a, b

Cristellaria bowdenensis Cushman, 1919, Carnegie Inst. Wash., no. 291, p. 37, pl. 8, fig. 2.

Cristellaria antillea Cushman, 1923, U. S. Nat. Mus., Bull. 104, pt. 4, p. 116, pl. 31, fig. 1; pl. 32, fig. 1; pl. 33, fig. 1; pl. 34, fig. 1.

Test may attain large size at which time it is compressed; 5 to 9 chambers in last formed whorl; close involute coiling in early stages becoming evolute coiled in the larger specimens where the last 3 or 4 chambers cease uniting in the umbilicus; periphery acute, keeled, early stages with flat, triangular-shaped acicular spines spaced at irregular intervals along the keel, later stages with the keel uninterrupted; sides of the keel may be beaded; sutures curved, limbate, raised and beaded in the early stages, often depressed and unornamented in the adult; sides of the chambers with a variable quantity of beading on the surface between the sutures. The tendancy of this species is toward an overall reduction in the amount of surface ornamentation in the later stages of development.

The aperture is roughly circular in outline, projects slightly above the outline of the periphery, and is filled with a spongy material in which there are numerous irregularly shaped cribrate openings. There is no median slit in the apertural face.

Range up to 5.0 mm.; hypotype (H. V. Howe Coll. No. 5292) 3.4 mm. maximum diameter, 1.0 mm. thickness.

Less than 15 percent of the specimens in the collection were well enough preserved to exhibit the true characteristics of the aperture.

The aperture on the majority of the specimens consisted of an apertural opening surrounded by a serrated ring of shell material. This would suggest, and has been so designated in the original description of "Cristellaria" antillea that the aperture was completely radiate. Evidently the spongy material which spans this irregularly radiate base is so fragile that it is rarely preserved, and probably less often preserved in materials older than Recent.

ROBULUS BURRWOODENSIS Andersen, n. sp.

Plate VII, figs. 1a, b

Test of medium size; broadly biconvex; 6 to 7 chambers in the last formed whorl; keel thin and narrow, entire; periphery slightly lobulate; sutures curved, limbate, depressed near the periphery, raised in the umbilical region; some specimens have an irregular knob of shell material in the center of the test where the sutures converge; apertural face broad, slightly concave.

The surface of the test on either or both sides may be ornamented with a few (3 or 4) insipiant costae which are oriented roughly parallel to the periphery and which may be confined to one or two chambers. The shell material of which the test is composed is very thick, has a milky appearance, and the surface is very rough and porous.

The aperture is round, greatly produced above the periphery in the apical angle of the test; and is filled with a spongy material in which there are numerous irregularly shaped cribrate openings. An elongate slit in the median line of the aperture and confined to the aperture constitutes the median slit. Maximum diameter of holotype (H. V. Howe Coll. No. 4293) 1.10 mm.; thickness 0.50 mm.

The aperture on all the large (adult?) specimens consisted of an apertural opening surrounded by a serrated ring of shell material. The description above is based upon immature specimens which seem to be better preserved.

ROBULUS CALCAR (Linne)

Plate VI, figs. 5a, b

"Nautilus minimus non umbilicatus", Gualtieri, 1742, Index. Test. Conch., pl. 19, fig. c.

Nautilus calcar Linnaeus, 1767, Syst. Nat., ed. 12, p. 1162, no. 272.

Test small to medium size; biconvex; 4 to 6 chambers in the last formed whorl, typically with 6; keel with a spine projecting outward from each chamber except the last formed chamber; spines on early chambers are removed by resortion as the spines near the aperture; clear spot in the umbilicus; sutures limbate, very slightly curved, radiating from the umbilicus tangental to the central clear spot; apertural face depressed, flat.

Aperture small, rounded, slightly produced above the periphery, radiations distinct and converging at center of opening. The median slit is concealed by two inward curved plates of shell material which enlarge at their inner margins to form an elliptical shaped opening directed downward. The inner margins of these plates which cover the median slit bear numerous irregular spiny projections. Hypotype (H. V. Howe Coll. No. 4294) 1.0 in maximum diameter, 0.55 mm. in thickness.

This is the species which is currently being regarded as R. calcar in the Gulf of Mexico-Carribean region.

ROBULUS CALCAR SOUTHPASSENSIS Andersen, n. var.

Plate VI, figs. 6a, b

Test small to medium size; biconvex; typically with 7 chambers in the last formed whorl; periphery acute, carinate, and faintly lobulate; clear spot in the umbilicus; sutures limbate, very slightly curved, radiating from the umbilicus tangental to the central clear spot; apertural face depressed, flat.

Aperture small, rounded, slightly produced above the periphery; radiations distinct and converging in the center of the aperture. The median slit is roughly triangular-shaped and is practically concealed by outward projecting plates of shell material which expand at the inner margin to form an elliptical opening directed downward. The inner margins of these plates, and occassionally the anterior margins bear numerous irregular spiny projections.

Maximum diameter of holotype (H. V. Howe Coll. No. 4295) 1.0 mm.; thickness 0.6 mm.

This is the same species figured by Brady as "Cristellaria" articulata Reuss (Challenger Rept., pl. 1, p. 69, figs. 10-12), which has been placed in synonymy with "Cristellaria" lucida Cushman (U. S. Nat. Mus., Bull. 104, pt. 4, p. 111). If Cushman's figure is representative of the species he established, it is very doubtful that the two are the same. "Cristellaria" lucida as figured, has a very wide keel and an aperture with a simple, elongate median slit. All of the specimens examined by the writer were identical to those figured by Brady which have an acute, carinate periphery, and an aperture as described above.

This is a spineless R. calcar, but it does not appear to be the

same as R. calcar var. aspinosa (Cushman) described from the Bowden marl, which has from 10 to 12 chambers as nearly as can be determined from a very inadequate description and figure. The maximum number of chambers found on any specimen of R. calcar southpassensis n. var. is 7.

ROBULUS cf. CLERICII (Fornasini)

Plate VI, figs. 2a, b

Cristellaria clericii Fornasini, "Cristellaria clericii, n. sp.", 1895, Bologna, tex.

Test small; biconvex; 5 chambers in the last formed whorl; periphery acute with thin, narrow keel; clear spot in the umbilicus; sutures strongly curved, only slightly limbate, not elevated above the surface of the test; apertural face typically depressed, occassionally convex, and almost completely occupied by the coiled portion of previous chambers.

Aperture elongate with plane of coiling, only slightly produced above the peripheral margin; radiations distinct, confined to the sides of the test. Median slit narrow, flanked on each side by a thin blade of shell material which terminates at the point where the keel intersects the apertural face. Maximum diameter of figured specimen (H. V. Howe Coll. No. 4296) 0.70 mm.; thickness 0.30 mm.

ROBULUS cf. CULTRATUS Montfort

Plate VI, figs. 4a, b

Robulus cultratus Montfort, 1808, "Conchyliologie systematique et classification methodique des coquilles", Paris, France, F. Schoell, tome 1, p. 215, fig. 214.

Test large, biconvex, many specimens biumbilicate; prominent keel entire; 8 to 11 chambers in the last formed whorl; clear spot in the umbilicus nearly circular in outline; sutures curved, limbate and not perceptably raised; apertural face depressed, flat.

Aperture elongate with plane of coiling, only slightly produced above the outline of the periphery; radiations distinct, confined to the sides of the test as the apical angle; peripheral keel extends to the outer margin of the median slit. Median slit relatively large, triangular, the apex of the triangle at the apical angle. The thin plates of shell material flanking the sides of the median slit curve inward partially concealing the outer portion of the median slit, and unite at the inner margin of the median slit to form a broad platform which projects forward from the apertural face.

Maximum diameter of figured specimen (H. V. Howe Coll. No. 4297) 1.50 mm.; thickness 0.72 mm.

A characteristic feature shared by these specimens and R. cultratus is the very prominent triangular-shaped median slit.

ROBULUS cf. FALCIFER (Stache)

Plate VI, figs. 9a, b

Cristellaria falcifer Stache, 1864, Novara Exped., Geol. Theil., vol. 1, pt. 2, p. 240, pl. 23, fig. 19.

Test large, biconvex; 8 to 10 chambers in the last formed whorl; keel thick and of medium width, entire; sutures strongly curved, radiating from a confused mass of suture remnants in the umbilical area; young specimens with broadly limbate and elevated sutures, adult chambers on larger specimens with sutures only slightly limbate and flush with the surface of the test; apertural face depressed, flat.

Aperture elongate with plane of coiling; radiations distinct, confined to the sides of the test with the radiations on each side firmly united at the outer margin but separated from the opposing radiations by a slight depression. Median slit triangular-shaped, partly covered by two inward curved plates of shell material approximately the same length as the median slit. Maximum diameter of figured specimen (H. V. Howe Coll. No. 4298) 2.2 mm.; thickness 0.9 mm.

There is a close relationship between this species and R. porteadsensis. Separation of the young can only be accomplished by examining the architecture of the aperture.

ROBULUS IOTUS (Cushman)

Plate VI, figs. 7a, b

Cristellaria iota Cushman, 1923, U. S. Nat. Mus., Bull. 104, pt. 4, p. 111, pl. 29, fig. 2; (not pl. 30, fig. 1).

Test large, thin, umbonate; young specimens moderately biconvex; large specimens with flattened sides; 11 to 13 chambers in the last

formed whorl; distinct evolute coiling; sutures curved, limbate, slightly depressed in large specimens; narrow depressed apertural face.

Aperture roughly circular in outline and projecting above the periphery at the apical angle of the test; radiations distinct, joining in the center of the aperture; approximately 9 openings formed between the radiations, 4 on each side of the test and the median slit in the apertural face; keel extends to outer margin of median slit. Median slit short and narrow, flanked on each side by a thin blade of shell material which projects forward perpendicular to the apertural face and terminates near the inner margin of the apertural slit. Maximum diameter of hypotype (H. V. Howe Coll. No. 4299) 2.10 mm.; thickness 0.40 mm.

In this study, where the position and nature of the aperture is given more consideration than the features normally used in establishing the different species of Robulus, it is most unfortunate that the aperture of the holotype[1] for "Cristellaria" iota Cushman is missing. Since the species was described from the northern part of the Gulf of Mexico, the specimens in the writer's collection can be considered topotypes and the description herein a just evaluation of R. iotus.

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[1] U.S.N.M. Cat. No. 18940 is labled holotype, Cristellaria iota Cushman, not U.S.N.M. Cat. No. 18939 as stated in U. S. Nat. Mus., Bull. 104, pt. 4, p. 111.

ROBULUS IOTUS BLOWERSI Andersen, n. var.

Plate VII, figs. 3a, b

Test of medium size, biconvex; 10 to 12 chambers in the last formed whorl; keel thick, relatively narrow, entire; slightly evolute, previous coils visible in the clear spot in the umbilicus; sutures slightly curved, limbate, greatly elevated above the surface of the test in the beginning coils, less prominent in the adult coils, apertural face depressed, flat.

Aperture roughly circular in outline and projecting above the periphery at the apical angle; radiations distinct joining in the center of the aperture; approximately 8 openings between the radiations 2 of which are in the plane of the periphery, the anterior one of these 2 forming the median slit. Median slit short, flanked on each side by a thin blade of shell material which projects forward perpendicular to the apertural face and terminates near the base of opening. Range in diameter up to 1.3 mm.; diameter of holotype (H. V. Howe Coll. No. 4300) 1.15 mm.; thickness 0.60 mm.

R. iotus blowersi n. var. differs from R. iotus (Cushman) in being much more broadly biconvex, having a narrower keel, and possessing a single posterior opening in the aperture which lies in the plane of the periphery.

ROBULUS PORTEADSENSIS Andersen, n. sp.

Plate VI, figs. 8a, b

Test of medium size, broadly biconvex; 6 to 10 chambers in the last formed whorl, normal occurrence 8 chambers per whorl; keel thick but not broad, entire; clear spot in the umbilicus; sutures raised,

curved and limbate, each individual suture more limbate in the central portion of the test where it merges into the clear shell material; sutures radiate from the center nearly tangental to the transparent central area.

Aperture elongate with plane of coiling; radiations distinct, confined to the sides of the test with the radiations on each side of the chamber firmly united at the outer margin but with the two sides commonly separated by an open slit in the plane of the periphery. This open slit, when present, connects with the median slit. Median slit narrow and elongate, flanked on each side by a thin blade of shell material which projects forward perpendicular to the apertural face. These fins decrease in height gradually, finally becoming merely parallel ridges traversing the apertural face to the point where the keel intersects the apertural face. Maximum diameter of holotype (H. V. Howe Coll. No. 4302) 1.80 mm.; thickness 0.90 mm.

The diagnostic features of this species are the limbate and elevated sutures which dominate the central portion of the test, and the elongate extensions to the fins which flank the median slit. "Robulina" costata d'Orbigny (species name preoccupied), though not too well illustrated or described, has the same general suture pattern as is present on this species. The similarity or lack of similarity between the apertures can not be determined from d'Orbigny's illustrations.

ROBULUS cf. SERPENS (Sequenza)

Plate VI, figs. 3a, b

Robulina serpens Sequenza, 1880, Mem. R. Accad. Lincei., ser. 3, vol. 6, p. 143, pl. 12, fig. 125.

Test small, biconvex, slightly biumbilicate; 5 to 6 chambers in the last formed whorl; periphery acute and often carinate; sutures limbate, curved, radiating from a large, circular umbilical knob; typically with a small, slightly convex apertural face.

Aperture small, rounded and directed slightly downward. The base of the aperture is roughly radiate (except for that portion which lies in the apertural face) and the apex typically covered with a spongy mass of shell material in which there are numerous irregular openings. In a few specimens a rather indefinite and indistinct radiate pattern is maintained from the base of the aperture to the apex. The median slit is small, confined almost entirely to the anterior portion of the aperture, and covered by two inward projecting plates which terminate near the inner margin of the opening. A thick, elliptical-shaped platform is developed at the base of the median slit. Maximum diameter of figured specimen (H. V. Howe Coll. No. 4303) 1.30 mm.; thickness 0.51 mm.

R. serpens (Sequenza) is the genotype for Cribrorobulina erected by Selli. The forms pictured by him have more pronounced and rounded cribrations than the specimens in the writer's material. This form needs additional study.

ROBULUS sp. "A"

Plate VII, figs. 4a, b

Test small to medium size, biconvex, completely involute with sutures radiating from a common center; periphery acute with a thin narrow keel; 6 chambers in last formed whorl; sutures arched, very slightly depressed, not limbate; apertural face convex, lobulate.

Aperture elongate with plane of coiling, slightly produced above the peripheral margin; radiations distinct and confined to the sides of the test; peripheral keel continues through the aperture to the outer margin of the median slit. Median slit narrow, elongate, flanked on each side by a thin blade of shell material which projects forward perpendicular to the apertural face. These fins decrease gradually in height and disappear beyond the inner margin of the median slit. Maximum diameter of figured specimen (H. V. Howe Coll. No. 4304) 1.3 mm.; thickness 0.6 mm.

The architecture of the aperture alone will not distinguish this species from Robulus sp. "B". The characteristic features of Robulus sp. "A" not shared by Robulus sp. "B" are: 1) the convex apertural face; 2) the non-limbate and depressed sutures; and 3) the completely involute manner of coiling.

This may be the Robulus oblongus of Coryell and Rivero.

ROBULUS sp. "B"

Plate VII, figs. 5a, b

Test small to medium size, biconvex; 6 to 7 chambers in last formed whorl; peripheral angle acute; keel entire; clear spot in the umbilicus; sutures curved, limbate in the central portion of the test;

apertural face small and flat, almost completely occupied by the preceeding volutions.

Aperture elongate with plane of coiling; radiations numerous, distinct and deeply incised, confined to the sides of the test; peripheral keel continues through the aperture to the outer margin of the median slit. Median slit narrow, elongate, flanked on each side by a thin blade of shell material which projects forward perpendicular to the apertural face. These fins decrease gradually in height until they become little more than parallel ridges at the inner margin of the median slit. Directly above the point where the keel intersects the apertural face these ridges curve outward and roughly parallel the keel for a short distance before they disappear. Maximum diameter of figured specimen (H. V. Howe Coll. No. 4305) 1.3 mm.; thickness 0.6 mm.

The relationship between this species and its nearest counterpart in the material examined is discussed under Robulus sp. "A".

ROBULUS sp. "C"

Plate VII, figs. 2a, b

Test of medium size, biconvex, biumbilicate; 6 to 7 chambers in the last formed whorl; wide, thin keel, entire; clear spot in the umbilicus; sutures limbate and acutely curved where they emerge from the umbilicus, completing approximately a half turn between the umbilicus and the periphery; aperture small and depressed.

Aperture elongate with plane of coiling, slightly produced above the periphery; radiations few and distinct, confined to the sides of the test; peripheral keel continues through the aperture to the outer margin of the median slit. Median slit large, triangular-shaped and

completely surrounded by shell material which on the sides of the opening are fin-like projections, and at the base form a small platform-like prominence.

Maximum diameter of figured specimen (H. V. Howe Coll. No. 4301) 0.90 mm.; thickness 0.45 mm.

This appears to be the R. orbicularis of H. B. Brady (Challenger Rept., pl. 69, fig. 17) which, along with numerous other species, has been placed in synonymy with R. vortex (Fichtel and Moll) by Cushman and Todd (Spec. Publ. 15, p. 15). The writer feels that the wholesale assignment of all forms with concentric sutures to R. vortex is not justified but is unable, at present, to select the species to which this form should be referred.

Genus LENTICULINA Lamarck, 1804

LENTICULINA cf. CONVERGINS (Bornemann)

Plate VII, fig. 6

Cristellaria convergins Bornemann, 1855, Deutsch. Geol. Ges., vol. 7, pt. 2, p. 327, pl. 13, figs. 16-17.

This appears to be one of the numerous forms currently being assigned to L. convergins.

LENTICULINA PEREGRINA (Schwager)

Plate VII, figs. 7a, b

Cristellaria peregrina Schwager, 1866, Novara Exped., Geol. Theil., vol. 2, p. 245, pl. 7, fig. 89.

Cristellaria variabilis H. B. Brady (not Reuss), 1884, Rep. Voy. Challenger, Zool., vol. 9, p. 541, pl. 68, figs. 11-16.

Very typical of the form assigned to this species.

Length of hypotype (H. V. Howe Coll. No. 4307) 0.50 mm.; breadth 0.32 mm.; thickness 0.20 mm.

Genus DENTALINA d'Orbigny, 1826

DENTALINA ATLANTICA (Cushman)

Plate VII, fig. 9

Nodosaria atlantica Cushman, 1923, U. S. Nat. Mus., Smithsonian Inst., Bull. 104, pt. 4, p. 68, pl. 12, figs. 11, 12.

The specimen figured is the microspheric form of D. atlantica. Megalospheric forms in the assemblage (not figured) are typical of paratype U.S.N.M. Cat. No. 18778.

Length of hypotype (H. V. Howe Coll. No. 4308) 1.21 mm.; maximum breadth 0.26 mm.

DENTALINA cf. CALOMORPHA (Reuss)

Plate VII, fig. 8

Nodosaria (Nodosaria) calomorpha Reuss, 1865, Denkschr. Akad. Wiss. Wien. vol. 25, p. 129, pl. 1, figs. 15-19.

It is very doubtful that this is the specimen described by Reuss, but it is similar to specimens from the Pacific which have been referred to D. calomorpha (Reuss) by Cushman and McCulloch.

Length of figured specimen (H. V. Howe Coll. No. 4309) 0.40 mm.

DENTALINA cf. COSTAI (Schwager)

Plate VII, fig. 13

Nodosaria costai Schwager, Novara-Exped., Geol. Theil, vol. 2, 1866, p. 229, pl. 6, fig. 62.

Similar forms have been placed indiscriminately in either D. filiformis (d'Orbigny) or D. costai (Schwager).

D. filiformis is described as having elliptical chambers; D. costai as having chambers which are more than twice as long as broad. The latter is more explicit in the relative dimensions of the chambers and is thus a more apt description of the specimens in the material.

Length of figured specimen (H. V. Howe Coll. No. 4310) 2.6 mm.; average length approximately 2.00 mm.

DENTALINA HARDINGI Andersen, new name.

Plate VII, fig. 14

Nodosaria consobrina var. emaciata Reuss. -H. B. Brady, 1884, Rep. Voy. Challenger, Zool., vol. 9, p. 502, pl. 62, figs. 25-26; -Flint, 1897 (1899), Rep. U. S. Nat. Mus., p. 310, pl. 55, fig. 1; -Cushman, 1923, U. S. Nat. Mus., Bull. 104, pt. 4, p. 78, pl. 13, figs. 3-5.

Test elongate, slightly curved, initial end broadly rounded; periphery smooth with last 2 or 3 chambers lobulate; chambers distinct, round in cross section, increasing very slightly in diameter and height as added; height of chambers about the same as the width throughout major portion of test; sutures distinct and limbate, the first 2 or 3 slightly diagonal, the remaining nearly horizontal; wall smooth; aperture typically centrally located, radiate. Length of holotype

(H. V. Howe Coll. No. 4311) 3.20 mm.; maximum breadth 0.30 mm.

The only reference to Nodosaria consobrina (d'Orbigny) var. emaciata (Reuss) the writer could find was in the Challenger Report. Brady states therein, that the 1865 version of the "emaciate" variety (of N. consobrina) is longer, has a larger number of segments with a shorter contour than the type. In the synonymy of Nodosaria consobrina var. emaciata Reuss, H. B. Brady, lists: Dentalina emaciata Reuss, 1851; Dentalina praelonga (Costa), 1856; and Nodosaria (Dentalina) consobrina var. emaciata Reuss, 1865.

If Reuss intended to introduce a new variety of D. consobrina in 1865, the variety needs a new name since D. emaciata is preoccupied (D. emaciata Reuss, 1851). If Reuss did not intend to describe a new variety in 1865, then Nodosaria (Dentalina) consobrina var. emaciata Reuss equals Dentalina emaciata Reuss which do not equal the specimens in this collection or the specimens figured by Brady, Flint and Cushman. Cushman apparently realized this when he prepared the Atlantic report but did nothing about the situation at that time.

DENTALINA MUCRONATA Neugeboren

Plate VII, figs. 10a, b

Orthocreas intortum "Soldani", Testaceographia, vol. 1, pt. 2, p. 98, pl. 105, fig. V.

Dentalina mucronata Neugeboren, 1856, Denkschr. Akad. Wiss. Wien., vol. 12, p. 83, pl. 3, figs. 8-11.

The specimen figured appears to be representative of the current group being identified as D. mucronata Neugeboren.

Length of hypotype (H. V. Howe Coll. No. 4312) 0.6 mm.; maximum

diameter 0.2 mm.

DENTALINA VERTEBRALIS ALBATROSSI (Cushman)

Plate VII, fig. 12

Nodosaria vertebralis var. albatrossi (Cushman), 1923, U. S. Nat. Mus., Smithsonian Inst., Bull. 104, pt. 4, p. 87, pl. 15, fig. 1.

Typical of this Gulf of Mexico species.

Length of hypotype (H. V. Howe Coll. No. 4313) 5.80 mm.; maximum breadth 0.40 mm.

DENTALINA sp. "A"

Plate VII, fig. 11

This costate specimen with a large proloculum and uniform sized chambers appears to be related to D. vertebralis albatrossi Cushman. It is left unidentified for the present.

Length of figured specimen (H. V. Howe Coll. No. 4314) 2.65 mm.; maximum diameter 0.40 mm.

Genus ENANTIODENTALINA Marie, 1941

Genotype Nodosaria (Dentalina) communis d'Orbigny

"Test elongate, subcylindrical, straight or slightly arcuate, chambers alternating in the early portion, a single series in the adult and less embracing, sutures very oblique; aperture terminal, radiate, slightly projecting."

Cushman's generic description above leaves everything to the imagination of the individual worker since the manner of "alternation" of chambers in the early portion of this dentaline form could be

accomplished in several ways. The manner chosen by the writer is that the early chambers on the curved side of the test are arranged in a quasi-biserial manner, after which they continue in the normal dentaline arrangement.

It is very difficult to evaluate this group of specimens. They appear in large numbers and except for the strange chamber arrangement in the initial stage of development, are identical to an equally large number of normal Dentalinas. In the development of the test the chambers have alternatingly slipped from one side of the test to the other instead of being added in a true linear series.

The writer is willing to accept the genus as a means of identifying this biserial initial stage in the Dentalina group but does not feel that there is adequate justification for placing the genus in the family Enantiomorphinidae as proposed by Marie (1941) or the family Polymorhinidae as specified by Cushman.

ENANTIODENTALINA COMMUNIS (d'Orbigny)

Plate VII, figs. 15a, b and 16a, b

Nodosaria (Dentalina) communis d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 254, no. 25.

Enantiodentalina communis (d'Orbigny) Marie, 1941, Mem. Mus. Nat. Hist. Nat., n. ser. vol. 12, p. 160.

This is that portion of a dentaline group currently being identified as D. communis (d'Orbigny), which has an irregular arrangement of initial chambers. Two variations are present in the assemblage, a large variety (fig. 15) with about 3 to 4 chambers in the uniserial portion, and a slender variety (fig. 16) with about 6 chambers in the uniserial segment.

These may represent microspheric and megalospheric forms.

Length of hypotype (H. V. Howe Coll. No. 4315) 0.95 mm.; breadth 0.22 mm.; length of hypotype (H. V. Howe Coll. No. 4316) 1.10 mm.; breadth 0.18 mm.

Genus LAGENONODOSARIA Silvestri, 1900

Genotype Nodosaria scalaris var. separans Brady

Test free, uniserial arrangement of chambers in a rectlinear series or slightly curved, rounded in cross section; chambers wholly or in part separated by a long neck-like extension; aperture at the end of a long neck, simple with or without phialine lip and radiations.

The microspheric form of some species in this genus have a distinct dentaline arrangement of chambers which merge inpreceptably or abruptly into the nodosaria-like adult. This type specimen could only be classified in a genus where characteristics other than the chamber arrangement are given major consideration. In this case the long lagena-like neck usually bearing a phialine lip is the important basis of classification.

LAGENONODOSARIA SEMIHISPIDA Andersen, n. sp.

Plate VII, figs. 21 and 22

Test of medium size. Megalospheric form (fig. 21) typically with 5 chambers in a rectalinear series, the first 4 subglobular, closely appressed, increasing very slightly in size as added, the final chamber elliptical, and separated from the preceeding chambers by a short neck; the initial 3 or 4 chambers ornamented with 25 to 30 rows of coarse spines, the final chambers and neck hispid; sutures distinct, depressed;

aperture a small circular opening at the end of a long neck, with phialine lip and rudimentary radiations. Microspheric form (fig. 22) with initial dentaline segment consisting of 6 to 7 chambers followed by 3 or 4 subglobular chambers arranged in the same manner as the megalospheric form; dentaline segment unornamented except for the last 1 or possibly 2 chambers which have several rows of coarse spines, the final chambers follow the ornamentation pattern of the megalospheric form; sutures distinct, diagonal to long axis of test. Length of megalospheric form, holotype (H. V. Howe Coll. No. 4319) 1.34 mm.; breadth 0.23 mm.

This can be distinguished from Nodosaria intercellularis H. B. Brady by the hispid ornamentation of the last chambers, and from Nodosaria hispida d'Orbigny by the longitudinal rows of spines on the initial chambers. It appears to be quite similar to Nodosaria substriatula Cushman described from the Philippines from which it can be distinguished by the greater number of chambers and the more consistent and uniformly developed initial chambers.

LAGENONODOSARIA SEMIINTERCELLULARIS Andersen, n. sp.

Plate VII, figs. 19 and 20

Test of medium size. Megalospheric form (fig. 19) typically with 5 chambers in a rectilinear series, the first 3 or 4 subglobular, closely appressed, increasing very slightly in size as added, the final chamber or chambers elliptical and separated from the preceeding by a short neck; surface ornamented by numerous longitudinal costae which breakup into spines at the base of each chamber near the suture line; sutures depressed, limbate and void or ornamentation; aperture a small

circular opening at the end of a long neck with phialine lip; 5 ridges at the apex of the phialine lip are interpreted as being rudimentary radiations; aperture ornamented with numerous, irregularly spaced transverse rings of shell material; initial chamber mucronate. Microspheric form (fig. 20) with a dentaline segment of 8 to 10 chambers followed by a single globular chamber about the size of the initial chamber in the megalospheric form; latter chambers ornamented with faint longitudinal costae or rows of spines; sutures of the dentaline segment distinct, diagonal to the long axis of the test. Length of megalospheric form, holotype (H. V. Howe Coll. No. 4321) 0.7 mm.; diameter 0.19 mm.

This species can be distinguished from Nodosaria intercellularis H. B. Brady, by the lack of closely set perforations in the later chambers, and from L. semihispida by the longitudinal costae present on all the chambers in the test. It can be distinguished from Nodosaria spinicosta d'Orbigny by the more finely costate surface.

LAGENONODOSARIA PYRULA (d'Orbigny)

Plate VII, fig. 18

Orthoceras Monile "Soldani", 1798, Testaceographia, vol. 2, p. 35, pl. 10, figs. b, c.

Nodosaria pyrula d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 253, no. 13.

Length of figured fragment (H. V. Howe Coll. No. 4318) 2.50 mm.

Genus PSEUDOGLANDULINA Cushman, 1929

PSEUDOGLANDULINA COMATULA (Cushman)

Plate VII, fig. 23

Nodosaria comatula Cushman, 1923, U. S. Nat. Mus., Bull. 104, pt. 4, p. 83, pl. 14, fig. 5.

According to Cushman's description of the genus Pseudoglandulina the chambers must be embracing with the last chamber making up a large portion of the test. The final chamber in this species rarely occupies any more of the test than any of the preceeding chambers and therefore should be classified as Nodosaria.

Length of hypotype (H. V. Howe Coll. No. 4323) 0.90 mm.; maximum breadth 0.40 mm.

NODOSARIA FUSTA Cushman and Todd

Plate VII, fig. 17

Nodosaria fusta Cushman and Todd, 1945, Cushman Lab. Foram. Res., Spec. Publ., No. 15, p. 28, pl. 4, figs. 20-22.

Compared with holotype (Cushman Coll. No. 44352).

Length of hypotype (H. V. Howe Coll. No. 4317) 3.5 mm.; diameter 0.55 mm.

Genus FRONDICULONODOSARIA Andersen, n. genus

Genotype Frondiculonodosaria nuda Andersen, n. sp.

Test free, multilocular, chambers arranged in a uniserial, rectilinear series, initial stages and microspheric form compressed with chevron-shaped chambers and sutures; adult chambers inflated, rounded with sutures at right angles to the long axis of the test; aperture

terminal, centrally located, radiate.

This genus combines the characteristics of the megalospheric form of Frondicularia and Nodosaria.

FRONDICULONODOSARIA NUDA, Andersen, n. sp.

Plate VII, figs. 24a, b and 25

Test small, slender and translucent; chambers in a rectilinear series; surface unornamented; sutures depressed, distinct; aperture terminal, radiate. Microspheric form (fig. 25) with sides flattened and slightly concave along the median line; chambers and sutures chevron-shaped with the angle of the sutures becoming more obtuse toward the apertural end of test; periphery lobulate. Megalospheric form (fig. 24) with 3 to 6 chevron-shaped chambers followed by a series of subglobose chambers, rounded in cross section and separated by straight, depressed sutures, periphery lobulate. Length of holotype (H. V. Howe Coll. No. 4324) 0.60 mm.; breadth 0.13 mm. Length of paratype (H. V. Howe Coll. No. 4325) 0.51 mm.; breadth 0.14 mm.; thickness 0.10 mm.

It is possible that the microspheric form of this species has been described as a Frondicularia, although there is no evidence of such an assignment in the literature at hand.

Genus MARGINULINA d'Orbigny, 1826

MARGINULINA AUGENS Cushman and Todd

Plate VIII, figs. 1a, b

Marginulina augens Cushman and Todd, 1945, Cushman Lab. Foram. Res., Spec. Publ. 15, p. 19, pl. 3, fig. 4.

The specimens in the material examined were found to be identical with M. augens Cushman and Todd described from the Bluff Bay of Jamaica. Contrary to the original description of this species, the surface of the test is not smooth, but has a very distinct corrugated exterior which varies in intensity from specimen to specimen. In extreme cases the surface has the appearance of the skin on a dehydrated apple.

The external appearance of the test in this species is extremely important in showing the relationship between M. augens and M. striatula Cushman. M. striatula was not mentioned in the discussion of M. augens, but a study of the holotypes of both species revealed that the two are very closely related and in all probability represent microspheric and megalospheric forms of the same species in the present material.

Length of hypotype (H. V. Howe Coll. No. 4326) 0.70 mm.; maximum breadth 0.33 mm.

MARGINULINA cf. GLABRA d'Orbigny

Plate VIII, figs. 3a, b

Marginulina glabra d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 259, no. 6; Modeles no. 55.

Similar specimens have been referred to this species, but the generic assignment is questionable since some of the specimens appear

to have an insipient median slit.

Length of figured specimen (H. V. Howe Coll. No. 4327) 0.53 mm.; maximum breadth 0.22 mm.

MARGINULINA cf. GLABRA OBESA Cushman

Plate VIII, figs. 6a-c and 7

Marginulina glabra d'Orbigny var. obesa Cushman, 1923, U. S. Nat. Mus., Bull. 104, pt. 4, p. 128, pl. 37, fig. 1.

These specimens are smaller but with the same relative inflation of chamber for size of test. The megalospheric form (fig. 7) follows the general pattern of those described but not figured by Cushman.

Length of microspheric form (H. V. Howe Coll. No. 4328) 0.80 mm.; breadth 0.50 mm. Length of megalospheric form (H. V. Howe Coll. No. 4329) 1.30 mm.; breadth 0.35 mm.

MARGINULINA MARGINULINOIDES (Goes)

Plate VIII, figs. 8a, b

Cristellaria aculeata d'Orbigny var. marginulinoides Goes, 1896, Harvard College Bull. Mus. Comp. Zool., vol. 29, p. 56, pl. 5, figs. 15-16.

It is difficult to determine exactly what characteristics distinguish M. marginulinoides (Goes). The original figured specimen shows greatly developed spines along the periphery of the coiled portion, but the description implies that the carinate and spiny periphery is an occassional occurrence, not the rule.

The specimens in this material are typically carinate, but without spiny projections along the carina.

Length of hypotype (H. V. Howe Coll. No. 4330) 1.5 mm.; maximum breadth 0.65 mm.; thickness 0.32 mm.

MARGINULINA STRIATULA Cushman

Plate VIII, figs. 2a, b

Marginulina striatula Cushman, 1913, Bull. 7, U. S. Nat. Mus., pt. 3, p. 79, pl. 23, fig. 4.

The larger forms in this material are identical with plesiotype U.S.N.M. Cat. No. 17509 figured in the U. S. Nat. Mus., Bull. 104. Additional comment on this species can be found in the discussion of M. augens Cushman and Todd.

Length of hypotype (H. V. Howe Coll. No. 4331) 0.70 mm.; maximum breadth 0.30 mm.

MARGINULINA SUBACULEATA GLABRATA (Cushman)

Plate VIII, figs. 9a, b

Cristellaria subaculeata Cushman var. glabrata Cushman, 1923, U. S. Nat. Mus., Bull. 104, pt. 4, p. 32, fig. 4; pl. 33, figs. 2, 3; pl. 34, fig. 3.

The development of the spines on the periphery of these specimens is not as great as the paratypes of the species.

Length of hypotype (H. V. Howe Coll. No. 4332) 1.30 mm.; maximum breadth 0.80 mm.; thickness 0.40 mm.

MARGINULINA VILLA Cushman

Plate VIII, figs. 4a, b and 5a, b

Marginulina villa Cushman, 1947, Contr. Cushman Lab. Foram. Res., vol. 23, p. 89, pl. 19, fig. 7-8.

The microspheric form is as described by Cushman.

Megalospheric form with test small, broadly rounded; early portion close coiled, later portion with a maximum of 2 chambers in the uniserial segment; chambers inflated, rounded in cross section; sutures distinct slightly depressed, and oblique in the uncoiled portion; surface smooth, wall translucent; aperture multiple and radiate at the end of a distinct neck which is expanded and lobulate at the outer end. This aperture, when viewed from above has a clover leaf design, the leaf-like extensions from 3 to 5 in number and with central perforations which are the aperture openings. The central area where these rings of shell material meet may be open or filled.

Length of megalospheric form (H. V. Howe Coll. No. 4334) 0.50 mm.; breadth 0.29 mm.; thickness 0.21 mm. Length of microspheric form (H. V. Howe Coll. No. 4333) 0.70 mm.; breadth 0.21 mm.; thickness 0.15 mm.

The microspheric and megalospheric forms of this species are very dissimilar. The former described by Cushman as M. villa has 3 to 5 chambers in the uniserial portion, is strongly compressed and has a very coarse hispid area surrounding the aperture. The megalospheric form is typically with less than 2 chambers in the uniserial segment, has greatly inflated chambers and has no hispid ornamentation. The only feature shared by both forms is the unusual aperture described above.

MARGINULINA sp. "A"

Plate VIII, figs. 10a, b

A single specimen ornamented with numerous fine, longitudinal costae, most of which continue across the suture lines, is recorded here for future reference.

Length of figured specimen (H. V. Howe Coll. No. 4335) 0.65 mm.; maximum breadth 0.22 mm.

MARGINULINA sp. "B"

Plate VIII, figs. 11a, b

This Marginulina can not be satisfactorily placed in any described species. It has a dentaline shape with a very small but distinct initial coil. It is very abundant in the material examined.

Length of figured specimen (H. V. Howe Coll. No. 4336) 1.50 mm.; maximum breadth 0.25 mm.

MARGINULINA sp. "C"

Plate VIII, fig. 12

This group differs from Marginulina sp. "B" in the position of the coil portion relative to side of the test on which the adult aperture is located. In this species the coil is located on the same side of the test as the aperture, an abnormal arrangement for forms which have a spiral to uncoiling chamber arrangement.

Length of figured specimen (H. V. Howe Coll. No. 4337) 0.92 mm.; maximum breadth 0.20 mm.

Genus VAGINULINOPSIS Silvestri, 1904

Genotype Vaginulina soluta Silvestri, var. carinata Silvestri

This genus covers those Vaginulina-like forms in which the early chambers are coiled and the sides of the test are flattened. Galloway placed this genus in synonymy with Hemicristellaria the genotype of which, according to Glaessner (1948) is a Marginulina.

VAGINULINOPSIS cf. CIBAOENSIS (Bermudez)

Plate VIII, figs. 15a, b

Lenticulina cibaoensis Bermudez, 1949, Cushman Lab. Foram. Res., Spec. Publ. 25, p. 133, pl. 8, figs. 33, 34.

The description of V. cibaoensis (Bermudez) from the Gurabo formation of the Dominion Republic so aptly applies to this group of specimens that it is inadvisable to establish a new species until the two assemblages are compared.

Length of figured specimen (H. V. Howe Coll. No. 4338) 2.75 mm.; maximum breadth 1.00 mm.; thickness 0.50 mm.

VAGINULINOPSIS cf. SUPERBA (Cushman and Renz)

Plate VIII, figs. 13a, b and 14

Marginulina superba Cushman and Renz, 1941, Contr. Cushman Lab. Foram. Res., vol. 17, p. 14, pl. 2, figs. 19-20.

This species appears to be similar to M. superba described from the Upper Agua Salada formation of Venezuela.

Length of microspheric form (H. V. Howe Coll. No. 4340) 0.65 mm.; breadth 0.40 mm.; thickness 0.15 mm. Length of megalospheric form (H. V. Howe Coll. No. 4339) 0.90 mm.; breadth 0.43 mm.; thickness 0.20 mm.

Genus SARACENARIA Defrance, 1824

SARACENARIA cf. ARCUATA (d'Orbigny)

Plate VIII, figs. 17a, b

Cristellaria arcuata d'Orbigny, 1846, Foram. Foss. Bass. Tert. Vienne, p. 87, pl. 3, figs. 34-36.

This species was described by H. B. Brady in the Challenger Report (pl. 114, fig. 17) as "Cristellaria" acutauricularis Fichtel and Moll. According to Cushman (Spec. Publ. No. 17, p. 11), the type figure of Fichtel and Moll is not very distinctive and that he (Cushman) has not found any specimens that seem entirely like it. Apparently after this study, the name S. acutauricularis was dropped and d'Orbigny's species S. arcuata was introduced.

D'Orbigny's specimens from the Vienne Basin have a slightly more flattened apertural face than the specimens in this collection.

Length of figured specimen (H. V. Howe Coll. No. 4341) 0.85 mm.; maximum breadth 0.33 mm.

SARACENARIA cf. ITALICA Drfrance

Plate VIII, figs. 16a, b

Saracenaria italica Defrance, 1824, Dict. Sci. Nat., vol. 32, p. 177.

So many different forms have been referred to S. italica Defrance that it is difficult to ascertain the true identity of this species.

Length of figured specimen (H. V. Howe Coll. No. 4342) 1.4 mm.; maximum breadth 1.00 mm.

SARACENARIA LATIFORMIS JAMAICENSIS Cushman and Todd

Plate VIII, figs. 18a-c

Saracenaria latiformis (H. B. Brady) var. jamaicensis Cushman and Todd, 1945, Cushman Lab. Foram. Res., Publ. 15, p. 32, pl. 5, fig. 7.

The specimens assigned to this variety are extremely variable in the arrangement of the initial chambers and are typically with a much greater length than the holotype (Cushman Coll. No. 44373).

Length of hypotype (H. V. Howe Coll. No. 4343) 0.9 mm.; maximum breadth 0.50 mm.

SARACENARIA SOUTHPASSENSIS Andersen, n. name

Plate IX, figs. 1a-c

Test elongate, roughly triangular in cross section, sides straight forming an acute angle at the periphery, apertural face slightly convex; early chambers without a definite coiled stage, the first 6 or 7 converging at the initial end of test, the remaining chambers in a uniserial series; sutures distinct, slightly depressed, sigmoid-shaped on the sides of the test, straight or with a slight curve on the apertural face. The aperture, situated at the apex of the final chamber, is radiate, slightly protruding, and with a well developed median slit. Final chambers in the apertural face are slightly overhanging. Length of holotype (H. V. Howe Coll. No. 4344) 1.23 mm.; breadth 0.40 mm.

S. southpassensis is the S. crepidula Fichtel and Moll of many authors. In 1941 when Cushman discussed the species described by Fichtel and Moll (Contr. Cushman Foram. Lab. Res., Spec. Publ. No. 17), "Nautulus" crepitula was reclassified as Planulina crepidula (Fichtel and Moll). It is apparent from this generic assignment that S. crepidula

is compressed and thus would not apply to these specimens from the material studied.

SARACENARIA TRIPARTITA Andersen, n. sp.

Plate IX, figs. 2a-c

Test elongate, roughly triangular in cross section, posterior angle acute, anterior corners rounded with apertural face somewhat convex; early chambers with a very small, close coil in microspheric form, megalospheric form without a definite coiled stage; sutures distinct, very slightly depressed; surface of test unornamented. Aperture radiate and only slightly protruding, situated on the apex of the final chamber. The apertural face is ornamented with two carinate ridges which originate at each inner angle of the last chamber, traverse the apertural face in a diagonal manner and converge at the aperture. These ridges thicken gradually toward the outer portion of the test, and as they near the aperture, develop a shelf-like projection of shell material which, in many specimens, practically conceals the median slit. The area in the median portion of the apertural face between the carinae is somewhat depressed (excavated). Length of holotype (H. V. Howe Coll. No. 4345) 1.4 mm.; breadth 0.60 mm.

The three-fold partitioning of the apertural face by two converging carinae is the distinctive feature of this species which appears to have no described counterpart.

Genus FRONDICULARIA Defrance, 1824

FRONDICULARIA COMPRESSA Costa

Plate IX, figs. 3, 4

Frondicularia compressa Costa, 1855 (1857), Mem. Accad. Sci. Napoli, vol. 2, p. 372, pl. 3, fig. 2.

This is the F. compressa described by Cushman and Todd from the Boden Marl. Both the microspheric and megalospheric forms are represented in the writer's material.

Length of megalospheric form (H. V. Howe Coll. No. 4346) 1.70 mm.; breadth 0.80 mm. Length of microspheric form (H. V. Howe Coll. No. 4347) 0.90 mm.; breadth 0.30 mm.

FRONDICULARIA SAGITTULA Vanden Broeck

Plate IX, figs. 5-8

Frondicularia alata d'Orbigny var. sagittula Vanden Broeck, 1876, Ann. Soc. Belge Micr., vol. 2, p. 113, pl. 2, figs. 12, 14.

Proponents of trimorphism in foraminiferal species should find F. sagittula a group worth of detailed study. The writer's hypodigm contains two very dissimilar megalospheric forms: one, represented by fig. 5, with narrow chambers; the second, represented by fig. 8, with very broad chambers. The latter appears to be the discordant group in the hypodigm since the microspheric forms (figs. 6 and 7) have small chambers similar to fig. 5.

Length of figs. 5 and 6 (H. V. Howe Coll. Nos. 4348 and 4349) 1.90 mm.; breadth 0.55 mm. Length of fig. 7 (H. V. Howe Coll. No. 4350) 3.10 mm.; breadth 1.80 mm. Length of fig. 8 (H. V. Howe Coll. No. 4351) 3.30 mm.; breadth 2.00 mm.

Genus LAGENA Walker and Jacob, 1798

LAGENA BALIZENSIS Andersen, n. sp.

Plate XI, fig. 19

Test elliptical in outline, circular in cross section, with base slightly truncated and mucronate; surface ornamented with 16 to 18 broad, longitudinal ribs which extend from the neck to the base of the test, but are separated from the basal spine by an unornamented, circular depression. These ribs which ornament the sides of the test are formed by a pair of costae which are bridged across the top by a thin layer of shell material. The aperture is a small circular opening at the apex of a short, ornamented neck. The ornamentation on the neck consists of 2 small flanges of shell material, one at the apex of the neck, the other, a larger acutely angled flange which lies between the body of the test and the flange at the apex of the neck. Length of holotype (H. V. Howe Coll. No. 4352) 0.38 mm.; breadth 0.22 mm.

This species can be distinguished from L. sulcata (Walker and Jacob) by the ornamentation on the neck.

LAGENA cf. DISTOMA Parker and Jones

Plate IX, fig. 9

Lagena laevis (Montagu) var. striata Parker and Jones (not L. striata) (Walker and Boys), 1857, Ann. Mag. Nat. Hist., ser. 2, vol. 19, p. 278, pl. 11, fig. 24.

A single specimen with 5 thin and broad longitudinal costae is assigned to L. distoma with the full knowledge that it is not typical of the Parker and Jones' forms. L. distoma is described as having delicate longitudinal "lines" which, according to Cushman, may range

from 6 to 12 in number. Length of figured specimen (H. V. Howe Coll. No. 4354) 1.9 mm.; breadth 0.20 mm.

LAGENA GRACILLIMA MOLLIS Cushman

Plate IX, fig. 10

Lagena gracillima (Sequenza) var. mollis Cushman, 1944, Contr. Cushman Lab. Foram. Res., Spec. Publ. No. 12, p. 21, pl. 3, fig. 3.

Compared with holotype (Cushman Coll. No. 40838) described from the New England Coast.

Length of hypotype (H. V. Howe Coll. No. 4355) 0.80 mm.; maximum breadth 0.10 mm.

LAGENA HISPIDULA Cushman

Plate IX, fig. 12

Lagena hispidula Cushman, 1913, U. S. Nat. Mus., Bull. 71, pt. 3, pl. 14, figs. 2, 3.

These specimens do not completely satisfy the "flask-shaped" test requirement of L. hispidula as stipulated in the original description, but are identical with the subglobular forms described by Cushman and McCulloch (1950) from the Pacific.

Length of hypotype (H. V. Howe Coll. No. 4356) 0.50 mm.; maximum breadth 0.22 mm.

LAGENA LAEVIS NEBULOSA Cushman

Plate IX, fig. 16

Lagena laevis (Montagu) var. nebulosa Cushman, 1923, U. S. Nat. Mus., Bull. 104, pt. 4, p. 29, pl. 5, figs. 4-5.

Typical of the forms described from the Carribean.

Length of hypotype (H. V. Howe Coll. No. 4357) 0.30 mm.; maximum breadth 0.11 mm.

LAGENA PERLUCIDA (Montagu)

Plate IX, fig. 18

Vermiculum perlucidum Montagu, 1903, Test. Brit., p. 525, pl. 15, fig. 3.

This is the form currently being assigned to L. perlucida (Montagu) Williamson. There is some question as to the validity of the name.

Length of hypotype (H. V. Howe Coll. No. 4358) 0.43 mm.; maximum breadth 0.18 mm.

LAGENA PORTEABSENSIS Andersen, n. sp.

Plate IX, fig. 15

Test circular in cross section, elongate, tapering from the greatest width near the base to the apex of a thin, elongate neck, base slightly truncate, mucronate; surface ornamented with 8 thin and high longitudinal costae which traverse the entire body and neck of the test and form slight projections at the base. The aperture is a small circular opening at the apex of the neck.

This species resembles L. lisbonensis Cushman and Todd from which it can be distinguished by the greater number of costae, the presence of a basal spine, and the lack of a lip at the aperture. It is very

similar in form to L. striato-punctata Parker and Jones but lacks the perforations on the costae.

Length of holotype (H. V. Howe Coll. No. 4359) 0.25 mm.; maximum breadth 0.09 mm.

LAGENA PYRAMA Andersen, n. sp.

Plate IX, fig. 20

Test small, globular, and mucronate; wall ornamented with thin and high, longitudinal costae in which every other costa extend from the basal spine to the base of the neck, the remaining costae extending from a point somewhat removed from the spine to the apex of the neck. The aperture is a small circular opening at the apex of a tubular neck which is about the same length as the chamber of the test. This neck is concealed by and ornamented with a triangular-shaped mass of shell material which has either a pentagonal or hexagonal cross section. The corners are formed by the costae which continue to the apex of the neck and the sides are formed by regularly spaced transverse layers of shell material. Length of holotype (H. V. Howe Coll. No. 4360) 0.20 mm.; breadth 0.10 mm.

This species is characterized by the massive, lattice-like ornamentation which surrounds the neck. A somewhat similar type of ornamentation can be found on L. squamosa sulcata Heron-Allen and Earland except that it is not as distinctly separated from the body of the test as in this species.

LAGENA cf. STRIATA (d'Orbigny)

Plate IX, figs. 13, 14

Oolina striata d'Orbigny, 1839, Foram. Amer. Merid., p. 21, pl. 5, fig. 12.

It appears that any globular to subglobular Lagena with numerous fine longitudinal costae and a long neck has been referred to or identified as L. striata. In following the pattern established by previous authors, the writer has complete disregard for the fact that d'Orbigny's L. striata has no ornamentation on the neck. Many new species have been established on differences much less than can be found in this group.

The specimens figured herein bear neck ornamentation of two distinctly different types. In fig. 14, the neck of the test is ornamented with closely spaced annular rings of shell material oriented transverse to the long axis of the test. In fig. 13, a few of the costae traverse the neck in a spiral manner.

Length of figured specimen (H. V. Howe Coll. No. 4362) 0.40 mm.; maximum breadth 0.26 mm. Length of hypotype (H. V. Howe Coll. No. 4361) 0.60 mm.; maximum breadth 0.39 mm.

LAGENA cf. SULCATA LAEVICOSTATA Cushman and Gray

Plate IX, fig. 11

Lagena sulcata (Walker and Jacob) var. laevicostata Cushman and Gray, 1946, Contr. Cushman Lab. Foram. Res., vol. 22, p. 68, pl. 12, figs. 13, 14.

This is the L. vulgaris var. substriata Williams of many authors. It does appear similar to Williams' 1858 version of the variety but not

the specimen he figured in 1848. It is this unquestionable status of Williams' species which has forced the writer to tentatively refer these specimens in L. sulcata laevicostata.

Length of figured specimen (H. V. Howe Coll. No. 4353) 0.51 mm.; maximum breadth 0.20 mm.

LAGENA SULCATA SPICATA Cushman and McCulloch

Plate IX, fig. 17

Lagena sulcata, apiculate forms, H. B. Brady, 1884, Rep. Voy. Challenger Rept., Zool., vol. 9, pl. 58, figs. 4, 17 (?).

Lagena sulcata (Walker and Jacob) var. apiculata Cushman (not Lagena apiculata Reuss), 1913, Bull. 71, U. S. Nat. Mus., pt. 3, p. 23, pl. 9, figs. 3, 4.

Compared with holotype of L. sulcata apiculata (U.S.N.M. Cat. No. 8531).

Length of hypotype (H. V. Howe Coll. No. 4363) 0.32 mm.; maximum breadth 0.20 mm.

Family POLYMORPHINIDAE

Genus GUTTULINA d'Orbigny, 1839

GUTTULINA PULCHELLA d'Orbigny

Plate IX, fig. 22

Guttulina pulchella d'Orbigny, 1839, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminiferes", p. 129, pl. 2, figs. 4-6.

Typical of the specimens reported from the Dry Tortugas, Florida, (Cushman Coll. No. 2222).

Length of hypotype (H. V. Howe Coll. No. 4365) 0.43 mm.; maximum

breadth 0.19 mm.

GUTTULINA SPICAEFORMIS (Roemer)

Plate IX, fig. 23

Polymorphina spicaeformis Roemer, 1838, Neues Jahrb. fur Min., p. 386, pl. 3, fig. 31.

Typical of the Dry Tortugas, Florida, specimens.

Length of hypotype (H. V. Howe Coll. No. 4366) 0.51 mm.; maximum breadth 0.28 mm.

Genus SIGMOMORPHINA Cushman and Ozawa, 1928

SIGMOMORPHINA sp. "A"

Plate IX, fig. 24

The single occurrence of a small, compressed Sigmomorphina can not be properly identified. It is figured only to record the presence of the genus in the assemblage.

Length of figured specimen (H. V. Howe Coll. No. 4367) 0.40 mm.; maximum breadth 0.16 mm.

Genus GLANDULINA d'Orbigny, 1826

GLANDULINA LAEVIGATA (d'Orbigny)

Plate IX, fig. 25

Nodosaria (Glandulina) laevigata d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 252, no. 1, pl. 10, figs. 1-3.

Length of hypotype (H. V. Howe Coll. No. 4368) 0.70 mm.; maximum breadth 0.60 mm.

Genus RAMULINA Rupert Jones, 1875

RAMULINA GLOBULIFERA H. B. Brady

Plate IX, fig. 21

Ramulina globulifera H. B. Brady, 1879, Quart. Journ. Micr. Sci., vol. 19, p. 58, pl. 8, figs. 32-33.

Overall length of hypotype (H. V. Howe Coll. No. 4364) 1.40 mm.

Family NONIONIDAE

Genus NONION Montfort, 1808

NONION BARLEEANA (Williamson)

Plate X, figs. 1a, b

Nonionina barleeana Williamson, 1858, "Recent Foraminifera of Great Britain", p. 32, pl. 3, figs. 68-69.

This appears to be the species described by Williamson from the coast of England. The distinguishing feature is the abrupt umbilical cavity which reveals a major portion of the preceeding volutions. About 9 to 12 chambers are present in the final whorl. Maximum diameter of hypotype (H. V. Howe Coll. No. 4369) 0.50 mm.; thickness 0.21 mm.

N. barleeana is quite similar to N. affine (Reuss) described from the Middle Oligocene of Hermstorf b. Berlin, Germany. The two species can be differentiated by the manner in which the chambers terminate at the open umbilicus; N. barleeana having a deep umbilical depression at which the chambers end abruptly and form a solid ring of clear material at the inner margin of the chambers; N. affine having a shallower depression, slightly more evolute manner of coiling and chambers which often have small extensions of shell material at their inner margins projecting into the umbilicus.

NONION CRAWFORDI Andersen, n. sp.

Plate X, figs. 2a, b

Test small, planispiral, somewhat evolute coiled; 10 to 12 chambers in the last formed whorl, slightly inflated and increasing in size only slightly as added; periphery broadly rounded, lobulate in the last three or four chambers; sutures distinct, limbate and flush with the surface of the test in the early coils, the sutures between the adult chambers slightly depressed at the outer margin and deeply incised at the inner margin; wall of the main body of the chamber smooth and coarsely perforated, umbilical region with numerous raised bosses of shell material which are visible from the peripheral view. The aperture consists of several round openings at the base of the apertural face. Maximum diameter of holotype (H. V. Howe Coll. No. 4370) 0.40 mm.; thickness 0.18 mm.

N. crawfordi n. sp. has every reason to be considered an Elphidium except that there is no evidence of retral processes extending across the suture lines. It is closely related to Elphidium australe Cushman and Parker which is described as having very short or inconspicuous process.

This species is named in honor of Major General R. W. Crawford, former President of the Mississippi River Commission.

NONION cf. DEPRESSULUM MATAGORDANUM Kornfeld

Plate X, figs. 5a, b

Nonion depressulum (Walker and Jacob) var. matagordanum Kornfeld, 1931, Stanford Univ., Dept. Geol. Contr., vol. 1, no. 3, p. 87, pl. 13, figs. 2a, b.

A single specimen from the inner neritic zones may belong here. It lacks the pronounced stellar thickening in the umbilicus of Kornfeld's figured specimen, but otherwise follows his general description of the species.

Maximum diameter of figured specimen (H. V. Howe Coll. 4371) 0.23 mm.; thickness 0.11 mm.

NONION FERINGAI Andersen, n. sp.

Plate X, figs. 3a, b

Test small, planispiral, completely evolute coiled; 6 to 7 chambers in the last formed whorl; periphery broadly rounded, lobulate; sutures distinct, depressed at outer margin, inner margin deeply incised, many specimens with a slight opening into the posterior portion of each individual chamber at this incision; wall coarsely perforate; aperture with a series of irregular cribrate openings at the base and inner margin of the last formed chamber. Maximum diameter of holotype (H. V. Howe Coll. No. 4372) 0.40 mm.; thickness 0.18 mm.

The aperture of N. feringai n. sp. is very similar to N. crawfordi n. sp. in that it is more suggestive of an Elphidium than a Nonion. In neither species is there any indication of retral processes bridging the sutures.

N. feringai has the same general appearance as N. germanicum

(Ehrenberg), the principal difference being in the nature of the aperture. Many specimens in the hypodigm do not have pronounced cribrations on the final chambers, but broken specimens reveal that there are always cribrate openings between the chambers in the previous chambers.

This species is very common in the inland brackish environments. It has never been observed in the mudlump clay.

NONION GRATELOUPI (d'Orbigny)

Plate X, figs. 4a, b

Nonionina grateloupi d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 294, no. 19.

Typical of those forms described from the Dry Tortugas, Florida.

Length of hypotype (H. V. Howe Coll. No. 4373) 0.40 mm.; breadth 0.22 mm.; thickness 0.12 mm.

Genus NONIONELLA Cushman, 1926

NONIONELLA ATLANTICA Cushman

Plate X, figs. 6a-c and 7a-c

Nonionella atlantica Cushman, 1947, Contr. Cushman Lab. Foram. Res., vol. 23, pt. 4, p. 90, pl. 20, figs. 4, 5.

The specimens in the material examined are slightly more inflated than the holotype (Cushman Coll. No. 49133) described from the coast of North Carolina.

Length of hypotype (H. V. Howe Coll. No. 4374) 0.40 mm.; breadth 0.33 mm.; thickness 0.21 mm. Length of hypotype (H. V. Howe Coll. No. 4375) 0.50 mm.; breadth 0.35 mm.; thickness 0.22 mm.

NONIONELLA cf. AURIS (d'Orbigny)

Plate X, figs. 10a-c

Valvulina auris d'Orbigny, 1839, Voyage dans l'Amerique Meridionale, vol. 5, pt. 5, "Foraminiferes", p. 47, pl. 2, figs. 15-17.

This is a very questionable assignment. The specimens from the material examined have a much smaller and more circular lobe on the ventral side than N. auris of the Gulf Coast Miocene. How nearly these Miocene forms compare with d'Orbigny's specimens have not been determined by the writer.

Length of hypotype (H. V. Howe Coll. No. 4376) 0.25 mm.; breadth 0.20 mm.; thickness 0.11 mm.

NONIONELLA BASILOBA Cushman and McCulloch

Plate X, figs. 8a-c

Nonionella basiloba Cushman and McCulloch, 1940, Hancock Pac. Exp., vol. 6, no. 3, p. 162.

In length and general chamber arrangement, it was found that the specimens in this material compared quite favorably with paratypes of N. basiloba from the Pacific coast, the main difference being that the Gulf of Mexico forms are slightly more inflated.

Length of hypotype (H. V. Howe Coll. No. 4377) 0.30 mm.; breadth 0.20 mm.; thickness 0.16 mm.

NONIONELLA OPIMA Cushman

Plate X, figs. 9a-c

Nonionella opima Cushman, 1947, Contr. Cushman Lab. Foram. Res., vol. 23, pt. 4, p. 90, pl. 20, figs. 1-3.

Compared with holotype (Cushman Coll. No. 49130) from the coast of North Carolina.

Length of hypotype (H. V. Howe Coll. No. 4378) 0.30 mm.; breadth 0.23 mm.; thickness 0.20 mm.

Genus ELPHIDIUM Montfort, 1808

ELPHIDIUM cf. EXCAVATUM (Terquem)

Plate X, figs. 13a, b

Polystomella excavata Terquem, 1875, Essai sur le classement des Animaux qui vivent sur la plage et dans les environs de Dunkerque, pt. 1, p. 25, pl. 2, figs. 2a-f.

Specimens from the samples studied have more shell material in the umbilicus than most of the plesiotypes in the Cushman collection.

Maximum diameter of figured specimen (H. V. Howe Coll. No. 4379) 0.33 mm.; thickness 0.19 mm.

ELPHIDIUM cf. FAX FAX Nicol

Plate X, figs. 12a, b

Elphidium fax Nicol subspecies fax Nicol, 1944, Journ. Pal., vol. 18, p. 177, pl. 29, figs. 3, 11.

These Gulf of Mexico forms are definitely related to the E. fax hypodigm of the Pacific coast but have a more acute periphery and fewer number of chambers per volution (15 to 16) than the mean of any

EXPLANATION OF PLATE I

ELPHIDIUM POEYANUM (d'Orbigny)

Plate X, figs. 14a, b

Polystomella poeyana d'Orbigny, 1839, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminiferes", p. 55, pl. 6, figs. 25, 26.

Typical of the species as reported from Jamaica and the Dry Tortugas, Florida.

Length of hypotype (H. V. Howe Coll. No. 4382) 0.50 mm.; thickness 0.22 mm.

ELPHIDIUM cf. TRANSLUCENS Natland

Plate X, figs. 16a, b

Elphidium translucens Natland, 1938, Scripps Inst. Oceanography Bull. Tech. Ser., vol. 4, p. 144, pl. 5, figs. 3, 4.

These are tentatively referred to E. translucens until Natland's species from the Pacific can be studied.

Maximum diameter of figured specimen (H. V. Howe Coll. No. 4383) 0.7 mm.; thickness 0.3 mm.

Genus BISACCIUM Andersen, n. sp.

Genotype Bisaccium imbricatum Andersen, n. sp.

Test free, calcareous perforate, planispiral, bilaterally symmetrical; chambers distinct consisting of a primary series of closely coiled chambers and a supplementary series in which each individual supplementary chamber covers the inner portion of the last formed chamber, a portion of each umbilicus and the last formed suture on both sides of the test; primary chambers inflated in the anterior portion, thinning posteriorly with sides becoming parallel at point of juncture with previously formed

chamber; sutures in the primary chambers depressed.

All exposed apertures are openings left between the supplementary and primary chambers, the most apparent and important of which are two hip-pocket-like openings in the median, distal portion of the apertural face, and the openings near the peripheral margin of each suture where the supplementary chamber suture-line extension terminates. The true aperture in the primary chamber, concealed by the supplementary chamber, lies at the base of the chamber in the median line.

The genus Bisaccium can not be placed satisfactorily in any family. It has been referred to the Nonionidae since the primary chambers, at least, conform with the basic pattern of the family. It might be desirable when additional species of this genus are reported to establish a new family to accomodate those planispiral forms with alternating primary and supplementary chambers. This new family could include the genus Bisaccium and possibly the genera Cushmanella and Astrononion.

Genus BISACCIUM IMBRICATUM Andersen, n. sp.

Plate X, figs. 17a, b

Test free, planispiral, bilaterally symmetrical; periphery rounded with last 3 or 4 chambers asymmetrically lobulate; chambers distinct consisting of a primary series of 7 or 8 closely coiled chambers which increase gradually in size as added and a supplementary series in which each individual supplementary chamber covers the inner 1/3 to 1/2 of the last formed chamber, a portion of each umbilicus and the last formed suture on both sides of the test; primary chambers inflated in the anterior portion, thinning posteriorly with sides becoming parallel at point of juncture with previously formed chamber; sutures in primary

chambers depressed except over periphery, curved and forming a lobe on the periphery. The true aperture in the primary chamber, invisible except in broken specimens, lies at the base of the chamber in the median line and is concealed by the supplementary chamber.

The supplementary chambers have triangular-shaped projections which extend into the umbilical region, and are imbricate in that each successive projection overlaps the previous one. When the projection and amount of overlap is uniform, a stellate pattern is formed on the side of the test.

The outer portion of the supplementary chamber is securely welded to the primary chamber except for: 1) two hip-pocket-like openings in the median, distal portion of the apertural face, 2) a variable number of small cribrate openings typically along the posterior margin of the extension which covers the sutures, and 3) an opening near the peripheral margin of each suture where the supplementary chamber suture-line extension terminates. All the above openings apparently served as apertures throughout the life of the individual. Even the pocket-like opening which is eventually concealed by subsequent supplementary chambers remains open in the depressed suture line. A small elliptical or circular opening (aperture ?) occurs within the supplementary chamber on both sides of the test.

Three specimens treated with dilute acid revealed a chitinous lining in the umbilicus of the primary chambers. The insoluble chitinous residue, consisting of a proloculum and 8 to 9 planispirally coiled chambers, ranged from 0.15 to 0.22 mm. in diameter. The supplementary chambers were completely dissolved.

The test is calcareous, finely perforate. The wall of the test is

so thin and fragile that specimens are rarely found with the last supplementary chamber preserved.

Maximum diameter of holotype (H. V. Howe Coll. No. 4201) is 0.52 mm.; thickness 0.20 mm.

Family PENEROPLIDAE

Genus PENEROPLIS Montfort, 1808

PENEROPLIS PROTEUS d'Orbigny

Plate XI, figs. 1a, b

Peneroplis protea d'Orbigny, 1839, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminiferes", p. 60, pl. 7, figs. 7-11.

Only the small (young ?) forms are present in the material examined.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4385) 0.50 mm.; thickness 0.10 mm.

Genus ARCHAIAS Montfort, 1808

ARCHAIAS ANGULATUS (Fichtel and Moll)

Plate XI, figs. 2a, b

Nautilus angulatus Fichtel and Moll, 1803, Test. Micr., p. 112, pl. 21.

These are typical of the young forms in Cushman's Dry Tortugas, Florida material. The specimens in the writer's collection all came from a sample of beach sand from Southwest Pass at the mouth of the Mississippi River.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4386) 0.50 mm.; thickness 0.30 mm.

Genus SORITES Ehrenberg, 1840

SORITES MARGINALIS (Lamarck)

Plate XI, fig. 3

Orbulites marginalis Lamarck, 1816, Syst. Anim. sans Vert., vol. 2, p. 196, no. 1.

Typical of the Dry Tortugas, Florida specimens.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4387) 0.85 mm.

Family BULIMINIDAE

Genus BULIMINELLA Cushman, 1911

BULIMINELLA ELEGANTISSIMA (d'Orbigny)

Plate XI, fig. 5

Bulimina elegantissima d'Orbigny, 1839, Voyage dans l'amerique meridionale, vol. 5, pt. 5, "Foraminiferes", p. 51, pl. 7, figs. 13, 14.

Rare in the mudlump clay but abundant in the Pleistocene sands near Mandeville, Louisiana.

Length of hypotype (H. V. Howe Coll. No. 4389) 0.30 mm.

Genus ROBERTINA d'Orbigny

ROBERTINA cf. BRADYI Cushman and Parker

Plate XI, figs. 4a, b

Robertina bradyi Cushman and Parker, 1936, Cushman Lab. Foram. Res., vol. 12, p. 99, pl. 16, figs. 9a, b

Two specimens can be referred to this species although neither appear to be absolutely typical.

Length of figured specimen (H. V. Howe Coll. No. 4388) 0.40 mm.; breadth 0.21 mm.

Genus BULIMINA d'Orbigny, 1826

BULIMINA BALIZENSIS Andersen, n. sp.

Plate XI, figs. 7a, b

Test small, elongate; chambers gradually and uniformly increasing in size as added, widest point at the last whorl, about 6 coils in adult form; chambers numerous, distinct, somewhat inflated, truncated and occassionally somewhat overhanging at the base; central portion of each chamber smooth and transparent, the margins and angelation at the base with a thickening of shell material through which can be traced 10 to 12 pore canals; on the exterior where these pore canals emerge are developed small protuberances which in some instances bear delicate spines directed straight downward; the truncated base of the chamber ornamented with a few short spines. The aperture, located at the apex of the test, is a large, circular opening formed by the last chamber, with the base of the opening directly above the next to last chamber. The margin of the aperture has a slight thickening of shell material and a single, triangular-shaped tooth. The microspheric form (fig. 7a) has a distinct triserial arrangement of chambers and a triangular cross section. Length of holotype, megalospheric form (H. V. Howe Coll. No. 4390) 0.40 mm.; breadth 0.10 mm. Length of paratype, microspheric form (H. V. Howe Coll. No. 4391) 0.30 mm.; breadth 0.11 mm.

This species can be distinguished from B. marginata by its smaller size, more tapered and elongate form, less undercutting at the base of the chambers, and less pronounced spiny ornamentation at the margins of the chambers. It appears to be quite similar to B. pulchella d'Orbigny an elongate form described from Chili, which Cushman and Parker have placed in synonymy with B. marginata d'Orbigny, (U.S.G.S.

Prof. Paper 210-D, p. 119).

BULIMINA EXILIS DEMINUTA Andersen, n. var.

Plate XI, figs. 6a, b

Test small, slender, length about 3 times the diameter; typically with 5 to 6 whorls of chambers, the first 2 rapidly increasing in size as chambers are added, the adult with sides nearly parallel; chambers inflated elliptical with base and top truncated, typically arranged in three vertical rows roughly parallel to the long axis of the test; sutures depressed and distinct, spiral suture pronounced in some specimens; wall smooth, polished, finely perforate. The aperture, located at the apex of the test, is a very small loop-shaped opening formed by the last chamber with the base resting on the next to the last chamber, and with a small tooth on one side. Length of holotype (H. V. Howe Coll. No. 4392) 0.32 mm.; maximum diameter 0.10 mm.

This variety differs from the typical form in being much shorter, having a much less acute initial end and a smaller aperture. It is present in greater quantities in the inner neritic zone and in moderate numbers in some of the mudlump clay.

BULIMINA (DESINOBULIMINA) cf. ILLINGI Cushman and Stainforth

Plate XI, fig. 11

Bulimina (Desinobulimina) illingi Cushman and Stainforth, 1946, Contr. Cushman Lab. Foram. Res., Spec. Pub. 14, p. 41, pl. 6, figs. 7a, b.

These specimens are referred to B. illingi on the basis of its occurrence in the Bluff Bay of Jamaica.

Length of hypotype (H. V. Howe Coll. No. 4393) 0.65 mm.; maximum

diameter 0.35 mm.

BULIMINA MARGINATA d'Orbigny

Plate XI, figs. 8-10

Bulimina marginata d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 269, no. 4, pl. 12, figs. 10-12.

The largest specimens from the material examined are about 3/4 the normal size of the paratypes in the Cushman collection.

Length of hypotype (H. V. Howe Coll. No. 4395) 0.40 mm.; breadth 0.30 mm.; length of hypotypes (H. V. Howe Coll. Nos. 4394 and 4483) 0.42 mm.; breadth 0.20 mm.

BULIMINA PYRULA d'Orbigny

Plate XI, figs. 12a, b

Bulimina pyrula d'Orbigny, 1846, "Foraminiferes fossiles de bassin tertaire de Vienne", p. 184, pl. 11, figs. 9, 10.

There is a tendancy for the final chambers in these forms to become involute, but not to the extent that any could be assigned to the genus Globobulimina.

Length of hypotype (H. V. Howe Coll. No. 4396) 0.40 mm.; maximum breadth 0.32 mm.

Genus VIRGULINA d'Orbigny, 1826.

VIRGULINA COMPLANATA Egger

Plate XI, fig. 16

Virgulina schreibersiana Czjzek var. complanata Egger, 1893, Abhandl. kon. bay. Akad. Wiss., Munchen, Cl. II, vol. 18, p. 292, pl. 8,

figs. 91, 92.

This is the form currently being assigned to V. complanata Egger.

Length of hypotype (H. V. Howe Coll. No. 4397) 0.54 mm.; maximum breadth 0.14 mm.

VIRGULINA PUNCTATA d'Orbigny

Plate XI, fig. 15

Virgulina punctata d'Orbigny, 1839, Ramon de La Sagra, p. 139, (plates published separately) vol. 8, pl. 1, figs. 35, 36.

Typical of the forms from the Dry Tortugas, Florida assigned to this species.

Length of hypotype (H. V. Howe Coll. No. 4398) 0.55 mm.; maximum breadth 0.18 mm.

VIRGULINA SCHREIBERSIANA Czjzek

Plate XI, fig. 13

Virgulina schreibersiana Czjzek, 1848, Haidinger's Nat. Abhandl., vol. 2, p. 11, pl. 13, figs. 18-21.

Typical of the form currently being assigned to this species.

Length of hypotype (H. V. Howe Coll. No. 4399) 0.60 mm.; maximum breadth 0.18 mm.

VIRGULINA cf. TENUIS Sequenza

Plate XI, figs. 14a-c

Virgulina tenuis Sequenza, 1862, Atti. Accad. Gioenia Sci. Nat., ser. 2, vol. 18, p. 28, pl. 2, figs. 2, 2a.

Test short and broad; chambers arranged in an unique biserial manner

in that the "zig-zag" suture line is only visible on one side of the test, the opposite side having two longitudinal rows of imbricate chambers separated by a deep suture line. This chamber arrangement could be accomplished by folding a normal biserial test along the central longitudinal axis. The aperture is loop-shaped and lies in the plane of the periphery.

Length of figured specimen (H. V. Howe Coll. No. 4400) 0.55 mm.; breadth 0.20 mm.

This appears to be the same as V. tenuis Sequenza described from the Pleistocene of Cantania, Sicily.

Genus BOLIVINA d'Orbigny, 1839

BOLIVINA ACEROSA SOUTHPASSENSIS Andersen, n. var.

Plate XI, fig. 19

Variety differing from the typical in the band of course perforations at the suture line and base of each chamber, the clear area in the central portion of each chamber and the faint longitudinal costae which may extend from the initial end to the base of the final chambers. Length of holotype (H. V. Howe Coll. No. 4401) 0.45 mm.; breadth 0.11 mm.

This variety can be distinguished from B. acerosa var. pacifica by its fine costate surface and larger clear spot on each chamber. It lacks the strong spine at the initial end and the intense costate surface of B. striatula var. spinata Cushman.

BOLIVINA ALATA (Sequenza)

Plate XI, fig. 18

Vulvulina alata Sequenza, 1862, All. Accad. Gioenia Sc. Nat., ser. 2, vol. 18, p. 115, pl. 2, figs. 5, 5a.

These forms currently being referred to B. alata are much broader than the type from the Pleistocene of Cantania, Sicily. It is doubtful if Sequenza's species has been properly interpreted.

Length of hypotype (H. V. Howe Coll. No. 4402) 0.63 mm.; maximum breadth 0.35 mm.

BOLIVINA ALBATROSSI Cushman

Plate XI, fig. 17

Bolivina albatrossi Cushman, 1922, U. S. Nat. Mus., Bull. 104, pt. 3, p. 31, pl. 6, fig. 4.

A few small or young forms can be assigned to this species.

Length of hypotype (H. V. Howe Coll. No. 4403) 0.30 mm.; maximum breadth 0.18 mm.

BOLIVINA cf. ISIDROENSIS Cushman and Renz

Plate XI, fig. 20

Bolivina isidroensis Cushman and Renz, 1941, Contr. Cushman Lab. Foram. Res., vol. 17, p. 17, pl. 3, fig. 8.

This is a difficult species to study. The chamber arrangement is concealed by a granulated exterior in much the same manner as the specimens from the material examined.

Length of figured specimen (H. V. Howe Coll. No. 4404) 0.41 mm.; breadth 0.13 mm.

The specimens referred to B. isidroensis occur only in the inner neritic sediments.

BOLIVINA SUBAENARIENSIS BALIZENSIS Andersen, n. var.

Plate XI, fig. 22

This variety differs from the typical in being much more elongate, having a greater number of chambers and numerous fine longitudinal costae confined to the initial end of the test.

Length of holotype (H. V. Howe Coll. No. 4406) 0.60 mm.; maximum breadth 0.18 mm.

BOLIVINA SUBAENARIENSIS MEXICANA Cushman

Plate XI, fig. 21

Bolivina subaenariensis var. mexicana Cushman, 1922, U. S. Nat. Mus., Bull. 104, pt. 3, p. 47, pl. 8, fig. 1.

Compared with holotype (Cushman Coll. No. 17129).

Length of hypotype (H. V. Howe Coll. No. 4405) 0.60 mm.; maximum breadth 0.25 mm.

BOLIVINA SUBSPINESCENS Cushman

Plate XI, fig. 25

Bolivina subspinescens Cushman, 1922, U. S. Nat. Mus., Bull. 104, pt. 3, p. 48, pl. 7, fig. 5.

These appear to be typical of the Gulf of Mexico-Carribean forms.

Length of hypotype (H. V. Howe Coll. No. 4407) 0.30 mm.; maximum breadth 0.09 mm.

BOLIVINA sp. "A"

Plate XI, fig. 23

This strongly compressed form with delicate spiny projections at the periphery satisfies the basic requirements of at least three different species: B. beyrichi Reuss, B. alata (Sequenza) and to a lesser degree B. pisciformis Galloway and Morrey. Since it is abundant in both the mudlump clay and the inner neritic zones, its presence has to be recorded but specific identification will be contigent upon much additional research.

Length of figured specimen (H. V. Howe Coll. No. 4408) 0.55 mm.

BOLIVINA sp. "B"

Plate XI, fig. 24

This is a very small form with a broadly rounded periphery and inflated chambers which is represented in both the inner neritic and mudlump clay. It is mentioned here as a matter of record but appears to be an undescribed species.

Length of figured specimen (H. V. Howe Coll. No. 4409) 0.35 mm.; breadth 0.10 mm.

Genus LOXOSTOMUM Ehrenberg, 1854

LOXOSTOMUM MEXICANUM Andersen, n. sp.

Plate XI, figs. 26a, b

Test small, elongate, sides somewhat compressed, and for the most part parallel, periphery rounded; chambers distinct, much broader than high, increasing in size only gradually but uniformly as added, final 3 or 4 chambers in a loose biserial arrangement tending to become

uniserial; 7 to 8 pairs of chambers in the adult test; sutures distinct and depressed. The initial 3 or 4 pair of chambers are ornamented with coarse spiny protuberances or short longitudinal ridges of shell material more or less concentrated in the central portion of the test. The adult chambers are smooth and unornamented except for a band of coarse perforations at the base of each chamber. Aperture in the final chamber is a large, circular opening, tending to become terminal. Length of holotype (H. V. Howe Coll. No. 4410) 0.45 mm.; maximum breadth 0.20 mm.; thickness 0.12 mm.

This species is very common in the mudlump clay where a large number never attain Loxostomum maturity. These young specimens in the Bolivina stage of development are similar to B. subspinescens but can be recognised by the coarse, spiny ornamentation in the central portion of the chamber.

Genus RECTOBOLIVINA Cushman, 1927

RECTOBOLIVINA ADVENA (Cushman)

Plate XI, figs. 27a, b

Siphogenerina advena Cushman, 1922, Carnegie Inst., Washington, Pub. 311, p. 35, pl. 5, fig. 2.

Compared with holotype (Cushman Coll. No. 2452) from the Tortugas, Florida.

Length of hypotype (H. V. Howe Coll. No. 4411) 0.55 mm.; maximum breadth 0.12 mm.

Genus REUSSELLA Galloway, 1933

REUSSELLA cf. MIOCENICA Cushman

Plate XI, fig. 30

Reussella miocenica Cushman, 1945, Contr. Cushman Lab. Foram. Res., vol. 21, pt. 2, p. 38, pl. 6, figs. 19, 20.

This appears to be similar to the large form described from the Miocene of Florida.

Length of figured specimen (H. V. Howe Coll. No. 4413) 0.70 mm.; breadth 0.40 mm.

REUSSELLA cf. SPINULOSA ATLANTICA Cushman

Plate XI, fig. 29

Reussella spinulosa (Reuss) var. atlantica Cushman, 1947, Contr. Cushman Lab. Foram. Res., vol. 23, pt. 4, p. 91, pl. 20, figs. 6, 7.

The smaller forms from the material examined appear to belong here.

Length of figured specimen (H. V. Howe Coll. No. 4414) 0.43 mm.; maximum breadth 0.20 mm.

Genus PAVONINA d'Orbigny, 1826

PAVONINA sp. "A"

Plate XI, fig. 28

The two specimens from the material examined neither satisfy the requirements of P. atlantica Cushman or P. miocenica Cushman. A larger suite of specimens must be obtained before these specimens can be properly identified.

Length of figured specimen (H. V. Howe Coll. No. 4412) 0.60 mm.; maximum breadth 0.60 mm.

Genus FISSURINA Reuss, 1850

Genotype Fissurina laevigata Reuss

Test monothalamous, compressed, subglobular or oval in outline; external aperture rounded, located in a fissure-like cavity or at the end of an extended neck; internal aperture at the end of an extended tubular process (entosolenian tube) in the body cavity. Entosolenian tube is typically centrally located but in some species may be directed toward one side of the test.

Since the author has found it desirable to use d'Orbigny's genus Oolina, it is necessary to substitute Fissurina for the genus Entosolenia. Galloway (1933) and Parr (1945) have placed the genotype for Entosolenia (E. lineata Williamson) selected by Cushman, 1927, in synonymy with Oolina d'Orbigny, 1839.

FISSURINA BIPARODA Andersen, n. sp.

Plate XII, figs. 1a, b

Test small, ovoid in front view, broadly lenticular in cross section; periphery carinate, developing into broad fin-like processes at the lateral margins of the base, the inner portion of the base with 2 to 4 spinose projections; apertural end with a small, cresent shaped supplementary chamber which lies above the main chamber. The entosolenian tube is attached at the base of the supplementary chamber and extends only a short distance into the body chamber. The internal apertures are round openings at each end of the entosolenian tube; the external aperture is a small round opening at the apex of the test. Wall on the sides of the test at margins and base with a horseshoe-shaped frosted surface, central portion clear and transparent. Length of

holotype (H. V. Howe Coll. No. 4415) 0.13 mm.; breadth 0.11 mm.; thickness 0.08 mm.

This appears to be the species reported from the Carribean by Flint as Lagena staphylleria Schwager (Ann. Rept. U. S. Nat. Mus., 1899 (1897), p. 307, pl. 54, fig. 1). Schwager's species has no pronounced keel and the long spines at the base of the test appear to be in intergral part of the body chamber. In F. biparoda n. sp. the spines are developed on a rudimentary keel.

FISSURINA CENTRO-LUCIDA Andersen, n. sp.

Plate XII, figs. 2a, b

Test pyriform in front view with base rounded and mucronate, elliptical in cross section; periphery with narrow carena; apical end extended into a very short neck. The entosolenian tube is long centrally located and curved with the distal end nearly touching one side of the test. The internal aperture is an elliptical opening at the flared distal end of the entosolenian tube; the exterior aperture is circular and is located at the apex of the short neck. Wall smooth with numerous coarse perforations except from a narrow, clear strip on either or both sides of the test. This translucent strip is usually clearly defined, and extends along the median line from the base of the neck to the center of the body chamber. Length of holotype (H. V. Howe Coll. No. 4416) 0.21 mm.; breadth 0.11 mm.; thickness 0.10 mm.

This species has been identified as F. laevigata (Reuss) by some authors from which it differs by being much less rotund. It can be distinguished from F. margion-perforata (Sequenza) by its shorter neck and less pronounced keel.

FISSURINA sp. "A"

Plate XII, figs. 3a, b

Test elongate, sub-cylindrical; in side view the apertural end is broadly rounded, the aboral end is subacute with two short, stout spines in the plane of the periphery; broadly elliptical in cross section, periphery unornamented. The aperture, a round circular opening, is located in a deep fissurine slit at the apex of a short, straight and centrally located entosolenian tube. The wall has a frosted appearance except for a narrow, well defined clear strip which marks the periphery on both sides of the test and surrounds the fissurine aperture. Length of figured specimen (H. V. Howe Coll. No. 4417) 0.30 mm.; breadth 0.13 mm.; thickness 0.12 mm.

As a matter of record, this appears to be one of H. B. Brady's Lagena truncatas (Challenger Rept., pl. 56, fig. 31 (not 32)) which Brady described as having either a rounded aperture (and radiate according to fig. 32, ibid.) or a fissurine aperture (fig. 31). It is the writer's opinion that L. truncata as it now stands does not constitute a very homogeneous species and that one of the two forms could be described as new. Which one of the two forms should be considered the valid L. truncata is a question that the writer can not answer with the material at hand.

Genus OOLINA d'Orbigny, 1839

Genotype Oolina laevigata d'Orbigny

Monothalamous, spherical or ovoid, round in cross section; aperture central, rounded or stellate, with entosolenian tube.

OOLINA CATENULATA (Jeffreys)

Plate XII, fig. 6

Lagennula catenulata Jeffreys Mss.

Entosolenia squamosa (Montagu) var. catenulata Williamson, 1848, Ann. Mag. Nat. Hist., ser. 2, vol. 1, p. 19, pl. 2, fig. 20.

This is typical of the species in which the areolae are relatively small and aligned in vertical rows. The entosolenian tube is not visible from the exterior.

Length of hypotype (H. V. Howe Coll. No. 4418) 0.40 mm.; maximum breadth 0.30 mm.

OOLINA CAUDIGERA (Wiesner)

Plate XII, fig. 4

Lagena (Entosolenia) globosa (Montagu) var. caudigera Wiesner, 1931, Deutsche Sudpolar Exped. Bd. 20 (Acologie Bd. 12), p. 119, pl. 18, fig. 21h.; (? pl. 18, p. 215).

This is one of two varieties of Oolina which Wiesner named O. caudigera in 1931; fig. 21h, ibid., O. globosa caudigera and fig. 21d, ibid., O. ovata caudigera. The former, which the writer considers valid and which has the same form as the specimens in this collection, has no external extension of the entosolenian tube.

Length of hypotype (H. V. Howe Coll. No. 4419) 0.30 mm.; maximum breadth 0.22 mm.

OOLINA HEXAGONA (Williamson)

Plate XII, fig. 5

Entosolenia squamosa (Montagu) var. hexagona Williamson, 1848, Ann. Mag. Nat. Hist., ser. 2, vol. 1, pl. 2, fig. 23.

The areolae on this species are arranged in an irregular manner. The entosolenian tube is visible from the exterior on many specimens.

Length of hypotype (H. V. Howe Coll. No. 4420) 0.20 mm.; maximum breadth 0.14 mm.

Genus CHRYSALIDINELLA Schubert, 1907

CHRYSALIDINELLA MEXICANA Andersen, n. sp.

Plate XII, fig. 7

Test small, elongate, about 4 times as long as wide, triserial portion broadly triangular, uniserial segment of 5 to 6 chambers with sides parallel; apertural end truncate, triangular in transverse section, slightly concave with sides carinate; sides of test slightly concave, edges acute and carinate; sutures distinct, limbate and raised; wall of test coarsely perforate. The aperture is composed of numerous, small openings in the depressed terminal face of each opening at the end of a short elevated tube (papilla). Length of holotype (H. V. Howe Coll. No. 4421) 0.51 mm.; maximum breadth 0.12 mm.

This species combines the characteristics of many forms. It can be distinguished from C. pulchella (Cushman) by its regular arrangement of chambers; from C. miocenica Cushman by its parallel sides, greater number of chambers in the uniserial segment and greater length relative to width of test; and from C. dimorpha Cushman by its papillate apertural face and non-spinose angles.

Genus UVIGERINA d'Orbigny, 1826

UVIGERINA FLINTII Cushman

Plate XII, fig. 8

Uvigerina flintii Cushman, 1923, U. S. Nat. Mus., Bull. 104, pt. 3, p. 165; pl. 42, fig. 13.

Compared with holotype (U.S.N.M. Cat. No. 17639).

Length of hypotype (H. V. Howe Coll. No. 4422) 0.72 mm.; maximum breadth 0.40 mm.

UVIGERINA cf. HISPIDO-COSTATA Cushman and Todd

Plate XII, fig. 10

Uvigerina hispido-costata Cushman and Todd, 1945, Contr. Cushman Lab. Foram. Res., Spec. Pub. 16, p. 51, pl. 7, figs. 27-31.

The specimens referred to this species are barely within the minimum size range and are not as coarsely hispid as the holotype (Cushman Coll. No. 14108).

Length of figured specimen (H. V. Howe Coll. No. 4423) 0.40 mm.; breadth 0.20 mm.

UVIGERINA PROBOSCIDEA VADESCENS Cushman

Plate XII, fig. 9

Uvigerina proboscidea Schwager var. vadescens Cushman, 1942, U. S. Nat. Mus., Bull. 161, pt. 3, p. 50, pl. 14, fig. 5-9.

Compared with holotype (Cushman Coll. No. 17515).

Length of hypotype (H. V. Howe Coll. No. 4424) 0.50 mm.; breadth 0.12 mm.

Genus ANGULOGERINA Cushman, 1927

ANGULOGERINA CRENULATA Andersen, n. sp.

Plate XII, fig. 12

Test small, elongate; chambers in the initial triserial portion indistinct, compactly appressed and ornamented with numerous short, stout spines; the last 3 to 4 chambers separated, acutely angular in cross section and obtusely truncated at the basal edge of each chamber. The corners at the sides and base of test bear a sharp crenulate carena. Wall of test coarsely perforate; adult chamber unornamented. The aperture is located at the apex of a slight neck with everted lip. Length of holotype (H. V. Howe Coll. No. 4427) 0.40 mm.; maximum breadth 0.18 mm.

The species appears to be similar to A. porrecta frimbriata (Sidebottom) reported from the Miocene of Cuba from which it can be distinguished by the spiny ornamentation on the initial chambers and the wide crenulate carinae.

ANGULOGERINA OCCIDENTALIS (Cushman)

Plate XII, fig. 13

Uvigerina occidentalis Cushman, 1923, U. S. Nat. Mus., Bull. 104, pt. 4, p. 169, (op. cit. pl. 5, figs. 3-4).

Fairly typical of paratype Cushman Coll. No. 38753 described from the Dry Tortugas, Florida.

Length of hypotype (H. V. Howe Coll. No. 4425) 0.30 mm.; maximum breadth 0.12 mm.

ANGULOGERINA cf. SELSEYENSIS (Heron-Allen and Earland)

Plate XII, fig. 11

Uvigerina selseyensis Heron-Allen and Earland, 1909, Journ. Roy. Micr., Sci., pt. 3, p. 437, pl. 18, figs. 1-3.

A number of undecorated specimens appear to belong here.

Length of figured specimen (H. V. Howe Coll. No. 4426) 0.40 mm.; breadth 0.19 mm.

Family ELLIPSOIDINIDAE

Genus PARAFISSURINA Parr, 1947

PARAFISSURINA LATERALIS (Cushman)

Plate XII, fig. 14

Lagena lateralis Cushman, 1913, U. S. Nat. Mus., Bull. 71, pt. 3, p. 9, pl. 1, fig. 1.

Compared with holotype (U.S.N.M. Cat. No. 8524).

Length of hypotype (H. V. Howe Coll. No. 4428) 0.30 mm.; maximum breadth 0.12 mm.; thickness 0.10 mm.

Family ROTALIIDAE

Genus SPIRILLINA Ehrenberg, 1843

SPIRILLINA VIVIPARA Ehrenberg

Plate XII, fig. 15

Spirillina vivipara Ehrenberg, 1841, Abhandl. k. Akad. Wiss. Berlin, p. 422, pl. 3, sec. 7, fig. 41.

Typical of the specimens from the Dry Tortugas, Florida, described as S. vivipara.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4429) 0.30 mm.

Genus PATELLINA Williamson, 1858

PATELLINA CORRUGATA Williamson

Plate XII, figs. 16a, b

Patellina corrugata Williamson, 1858, Rec. Foram. Gt. Britain, p. 46, pl. 3, figs. 86-89.

Typical of the specimens currently being assigned to this species.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4430) 0.30 mm.

Genus DISCORBIS Lamarck, 1804

DISCORBIS BERTHELOTI FLORIDENSIS Cushman

Plate XII, figs. 18a-c

Discorbis bertheloti (d'Orbigny) var. floridensis Cushman, 1930, Journ. Pal., vol. 4, no. 4, p. 364, pl. 33, fig. 13.

Typical of the specimens from Fowey, Florida. Compared with holotype (Cushman Coll. No. 12889).

Maximum diameter of hypotype (H. V. Howe Coll. No. 4431) 1.30 mm.; thickness 0.40 mm.

DISCORBIS CANDEIANA (d'Orbigny)

Plate XII, figs. 20a-c

Rosalina candeiana d'Orbigny, 1839, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminiferes", p. 97, pl. 4, figs. 2-4.

Typical of the specimens from Fowey, Florida, identified as this species.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4432) 0.53 mm.; thickness 0.20 mm.

DISCORBIS ORBICULARIS (Terquem)

Plate XII, figs. 17a, b

Rosalina orbicularis Terquem, 1876, Anim. sur la plage de Dunkeque, p. 75, pl. 9, figs. 4a, b.

It appears that most authors have used H. B. Brady's interpretation of D. orbicularis (Terquem) which the specimens in this collection resemble.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4433) 0.22 mm.

DISCORBIS PULCHRA Cushman

Plate XII, figs. 19a-c

Discorbis pulchra Cushman, 1947, Contr. Cushman Lab. Foram. Res., vol. 23, pt. 4, p. 91, pl. 20, fig. 9.

This appears to be the same species Cushman described from off the coast of North Carolina.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4434) 0.78 mm.; thickness 0.20 mm.

Genus AAPTOSTOMA Andersen, n. gen.

Genotype Aaptostoma mexicana Andersen, n. sp.

Test free, multilocular, trochoid; sutures on dorsal side visible, ventral sutures and umbilical region (occassionally the entire ventral side of the test) covered with a thick pustulose coating. The true aperture, an arched opening at the base and anterior portion of the final chamber on the ventral side of the test, is concealed by pustulose material; supplementary apertures typically visible from the exterior but concealed in some species, are developed at the base and

posterior, outer margin of each chamber on the ventral side of the test.

This is an Eponides with supplementary apertures formed at the posterior outer margin of each chamber and a pustulose covering on the ventral side of the test. The known range of the genus is Oligocene to Recent.

AAPTOSTOMA MEXICANA Andersen, n. sp.

Plate XII, figs. 21a-c

Test trochoid, rounded in side view, unequally biconvex with dorsal side strongly arched, ventral side nearly flat; periphery acute, lobulate and with a slight thickening of the shell material on the outer margin of each chamber; chambers distinct, slightly inflated along periphery and on ventral side, 7 to 9 in final whorl increasing gradually in size as added; dorsal sutures at a considerable angle with the periphery, slightly limbate and somewhat imbricate in the adult forms; ventral side with dutures depressed, slightly curved and partially or completely covered by pustulose filling which also conceals the umbilicus. The only visible apertures are elongate slits at the posterior, inner margin of each chamber on the ventral side which start at the periphery and extend inward for a distance of about 1/3 the length of the chamber. Occassionally these slits are not confined to the base of the chamber, but curve into the chamber proper. Surface smooth and unornamented except for pustulose material in the umbilical region and along the sutures on the ventral side. Maximum diameter of holotype (H. V. Howe Coll. No. 4435) 0.35 mm.; thickness 0.20 mm.

This species can be distinguished from A. alabamensis (Cushman and McGlamery) by the greater number of chambers and visible apertures

along the periphery.

Genus VALVULINERIA Cushman, 1926

VALVULINARIA MEXICANA Andersen, n. sp.

Plate XII, figs. 23a-c

Test trochoid, unequally biconvex, periphery lobulate and broadly rounded, about 2 coils in adult test; dorsal side with chambers somewhat involute, spire slightly depressed; ventral side with a deep and broad umbilicus; chambers distinct, 8 in the last-formed whorl, slightly inflated and increasing gradually in size as added; sutures distinct, depressed, and slightly curved on both dorsal and ventral sides; wall smooth, coarsely perforate except for a small triangular-shaped clear area at the inner margin of each chamber on the ventral side, and a large triangular clear area at the anterior portion of the final chamber. Aperture in the open umbilicus is typically covered by a concave-convex shaped lip which projects from the inner margin of the last chamber, occassionally the lips formed on previous chambers are also visible in the umbilicus. Maximum diameter of holotype (H. V. Howe Coll. No. 4436) 0.32 mm.; thickness 0.18 mm.

Similar specimens have been incorrectly referred to V. araucana (d'Orbigny) described from the Pacific area. This species has fewer chambers in each coil and a much greater thickness for size of test than the specimen figured by d'Orbigny.

VALVULINERIA VILARDEBOANA GLABRA Cushman

Plate XII, figs. 22a, b

Valvulinaria vilardeboana (d'Orbigny) var. glabra Cushman, 1927

Scripps Inst. Oceanogr., Tech. Ser., vol. 1, p. 161, pl. 4, figs. 5, 6.

Compared with holotype (Cushman Coll. No. 20300).

Maximum diameter of hypotype (H. V. Howe Coll. No. 4437) 0.35 mm.; thickness 0.18 mm.

Genus ROTALIA Lamarck, 1804

ROTALIA BECCARII PARKINSONIANA (d'Orbigny)

Plate XII, figs. 25a, b

Rosulina parkinsoniana d'Orbigny, 1839, in De la Sagra, Hist. Fis. Pol. Cuba, "Foraminiferes", p. 99, pl. 4, figs. 25-27.

Compared with plesiotypes from the Miocene of Florida. Common in the inner neritic sediments and Pleistocene sands of Mandeville, Louisiana.

ROTALIA BECCARII TEPIDA Cushman

Plate XII, figs. 24a, b

Rotalia beccarii (Linnaeus) var. tepida Cushman, 1926, Publ. 344, Carnegie Inst., Washington, p. 79, pl. 1.

Typical of the specimens described from Puerto Rico.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4439) 0.36 mm.; thickness 0.20 mm.

Common in the inner neritic zones, rare in the mudlump clay.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4438) 0.60 mm.; thickness 0.30 mm.

Genus EPONIDES Montfort, 1808

EPONIDES BALIZENSIS Andersen, n. sp.

Plate XIII, figs. 4a-c

Test small, rounded in side view, trochoid, dorsal side strongly convex and uniformly arched, ventral side somewhat flattened and truncated in the center; periphery slightly lobulate, subacute; chambers small, gradually increasing in size, 9 to 11 in the final whorl; chambers added on the ventral side of the periphery; dorsal spire coated with a thin, transparent layer of shell material which smooths-out the depressions in chamber and coil sutures, and through which can be seen all the chambers in the test; ventral side with an open umbilical depression through which there is no opening into the chambers; sutures distinct, limbate and straight on both sides of the test, slightly depressed on ventral side and where they cross the periphery. The aperture is a small arched opening with a slight lip formed at the base of the final chamber about midway between the periphery and the umbilicus. The walls are finely perforate, unornamented and with a high polish. Maximum diameter of holotype (H. V. Howe Coll. No. 4440) 0.25 mm.; thickness 0.11 mm.

This species is rare in both the mudlump clay and the sediments from the inner neritic zones. There appears to be nothing similar described from the Gulf of Mexico-Carribean region.

EPONIDES CORYELLI Palmer

Plate XIII, figs. 2a-c

Eponides coryelli Palmer, 1945, Bull. Amer. Pal., vol. 29, no. 115, p. 58, pl. 2, figs. 3, 4.

This is the form currently being identified as E. coryelli Palmer.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4441) 1.00 mm.; thickness 0.65 mm.

EPONIDES PARANTILLARIUM Galloway and Hemirway

Plate XIII, figs. 1a-c

Eponides antillarum Cushman and Jarvis (not d'Orbigny), 1930, Journ. Pal. Vol. 4, p. 364, pl. 33, fig. 14, pl. 34, fig. 2.

Eponides parantillarium Galloway and Hemirway, 1941, New York Acad. Sci. Sei. Surv., Puerto Rico and Virgin Islands, vol. 3, pt. 4, p. 374, pl. 18, fig. 1. -Cushman and Todd, 1945, Cushman Lab. Foram. Res., Spec. Pub. 15, p. 58, pl. 9, figs. 6, 7.

This is the form described by Cushman and Jarvis as E. antillarum (fig. 14a-c, ibid.), plesiotype, Cushman Coll. No. 14114.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4442) 0.80 mm.; thickness 0.45 mm.

EPONIDES UMBONATUS ECUADORENSIS (Galloway and Morrey)

Plate XIII, figs. 3a-c

Rotalia ecuadorensis Galloway and Morrey, 1929, Amer. Pal., vol. 15, no. 55, p. 26, pl. 3, fig. 13.

Eponides umbonatus (Reuss) var. ecuadorensis (Galloway and Morrey), 1949, Cushman Lab. Foram. Res., Spec. Pub. 25, p. 249, pl. 17,

figs. 25-27.

These specimens differ from the typical in having a sharper keel, and sinuous sutures in the ventral umbo.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4443) 0.40 mm.; thickness 0.10 mm.

Genus STOMATORBINA Dorreen, 1948

Genotype Stomatorbina torrei (Cushman and Bermudez)

"Low trochoid spire, dorsal sutures broad and limbate; ventral sutures sharp and depressed; periphery usually subacute; aperture ventral, an elongate slit at base of last chamber; supplementary apertures, or clear spaces on ventral side of each chamber, just below periphery, elongated spirally, depressed below surrounding surface and closed by smooth shell material, usually of slightly different color from that of the rest of the ventral surface."
(Dorreen, J. M., Journ. Paleo., 1948, vol. 22, no. 3, p. 295.)

STOMATORBINA CONCENTRICA (Parker and Jones)

Plate XIII, figs. 5a-c

Pulvinulina concentrica Parker and Jones, 1864, Trans. Linn. Soc. London, vol. 24, pt. 3, p. 470, pl. 43, fig. 14.

Representative of the specimens in the Cushman Collection.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4444) 0.60 mm.; thickness 0.23 mm.

Genus POROEPONIDES Cushman, 1944

POROEPONIDES LATERALIS (Terquem)

Plate XIII, figs. 6a-c

Rosulina lateralis Terquem, 1878, Mem., Soc. Geol. France, ser. 3, tome 1, no. 3, p. 25, pl. 2, figs. 11a-c.

Typical of the specimens reported from New Port, R. I. (Cushman Coll. No. 41234). The young and an occassional adult form has a closed umbilicus.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4445) 1.30 mm.; thickness 0.50 mm.

Genus CANCRIS Montfort, 1880

CANCRIS SAGRA (d'Orbigny)

Plate XIII, figs. 7a, b

Rotalina sagra d'Orbigny, 1839, in De la Sagra, Hist. Fis. Pol. Cuba, "Foraminiferes", p. 77, pl. 5, figs. 13-15.

This Jamaican form described by d'Orbigny appears to be a satisfactory assignment for the specimens from the material studied. It is common in the mudlump clay but rare in the inner neritic sediments.

Length of hypotype (H. V. Howe Coll. No. 4446) 0.88 mm.; breadth 0.53 mm.; thickness 0.31 mm.

Genus EPISTOMINA Terquem, 1883

EPISTOMINA ELEGANS (d'Orbigny)

Plate XIII, figs. 8a-c

"Nautili Ammonidormes sive trochiformes", Soldani, 1798, Test., vol. 2, app., pl. 2, fig. R.

Rotalia (Turbinulina) elgans d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 276, no. 54, (not Rotalia elgans, Ann. Sci. Nat., vol. 7, 1826, p. 272, no. 6, nomen nudum).

Typical of the forms from Fowey, Florida.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4447) 0.60 mm.;

thickness 0.35 mm.

Genus SIPHONINA Reuss, 1850

SIPHONINA PULCHRA Cushman

Plate XIII, figs. 9a-c

Siphonina pulchra Cushman, 1919, Carnegie Inst., Washington, Pub. 291, p. 42, pl. 14, figs. 7a-c.

Compared with holotype (Cushman Coll. No number) from Cuba.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4448) 0.60 mm.; thickness 0.30 mm.

Family AMPHISTEGINIDAE

Genus AMPHISTEGINA d'Orbigny, 1826

AMPHISTEGINA LESSONII d'Orbigny

Plate XIII, figs. 10a-c

Amphistegina lessonii d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 304, no. 3, pl. 17, figs. 1-4.

There is some question as to the proper assignment of these forms. Most of the difficulty stems from the confused status of the nomenclature of the species of Amphistegina, particularly A. lessonii d'Orbigny.

The specimens from the material examined unquestionably fall in the wide range of forms being assigned to A. lessonii. However, when compared with plesiotypes in the Cushman Collection, they were found to be larger and thicker than the Dry Tortugas, Florida forms which should be the best reference assemblage for the writer's material.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4449) 1.95 mm.;

thickness 1.00 mm.

Family CYMBALOPORIDAE

Genus TRETOMPHALUS Moebius, 1880

TRETOMPHALUS cf. PACIFICUS Cushman

Plate XIII, figs. 11a, b

Tretomphalus pacificus Cushman, 1934, Contr. Cushman Lab. Foram. Res., vol. 10, pt. 4, p. 93, pl. 11, fig. 7; pl. 12, figs. 8-12.

A few specimens appear to belong here rather than with T. atlanticus Cushman most commonly reported from the Gulf of Mexico-Carribean area. T. atlanticus has chambers arranged in fours; T. pacificus and the forms from the writer's material have chambers arranged in threes.

Maximum diameter of figured specimen (H. V. Howe Coll. No. 4450) 0.40 mm.; thickness 0.15 mm.

Family GLOBIGERINIDAE

Genus GLOBIGERINA d'Orbigny, 1826

GLOBIGERINA BULLOIDES d'Orbigny

Plate XIV, figs. 1a, b

Globigerina bulloides d'Orbigny, 1826, Ann. Sci. Nat., p. 277; Modeles Nos. 17, 76.

Compared with topotypes from Rimini, Italy, (Cushman Coll. No. 49987).

Small forms (young ?) are rare in the inner neritic sediments.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4452) 0.76 mm.; thickness 0.40 mm.

GLOBIGERINA CONGLOMERATA Schwager

Plate XIV, figs. 2a, b

Globigerina conglomerata Schwager, 1866, Novara-Exped., Geol. Theil, vol. 2, p. 255, pl. 7, fig. 113; Tertiary, Kar. Nikobar, India.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4451) 0.70 mm.; thickness 0.50 mm.

Genus GLOBIGERINOIDES Cushman, 1927

GLOBIGERINOIDES CONGLOBATA (H. B. Brady)

Plate XIV, fig. 4

Globigerina conglobata H. B. Brady, 1879, Quart. Journ. Micr. Sci., vol. 19, p. 72.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4453) 1.00 mm.

GLOBIGERINOIDES RUBRA (d'Orbigny)

Plate XIV, figs. 3a, b

Globigerina rubra d'Orbigny, 1839, in De la Sagra, Cuba, "Foraminiferes", p. 82, pl. 4, figs. 12-14; Recent, West Indies.

A few small forms have been recovered from the inner neritic sediments studied.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4454) 0.68 mm.; thickness 0.60 mm.

GLOBIGERINOIDES SACCULIFERA (H. B. Brady)

Plate XIV, figs. 5a, b

Globigerina sacculifera H. B. Brady, 1877, Geol. Mag., dec. 2, vol. 4, p. 535.

Only the larger forms bear the typical compressed and notched last chamber. The young forms may be present in the inner neritic zones but they are difficult to distinguish from a Globigerina.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4455) 0.91 mm.; minimum diameter 0.70 mm.; thickness 0.62 mm.

Genus SPHAEROIDINELLA Cushman, 1927

SPHAEROIDINELLA DEHISCENS (Parker and Jones)

Plate XIV, figs. 6a, b

Sphaeroidina dehiscens Parker and Jones, 1865, Philos. Trans., p. 639, pl. 19, fig. 5; Recent, Atlantic Ocean.

Very typical of this species.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4456) 0.90 mm.; minimum diameter 0.72 mm.

Genus GLOBIGERINELLA Cushman, 1927

GLOBIGERINELLA AEQUILATERALIS (H. B. Brady)

Plate XIV, figs. 7a, b

Globigerina aequilateralis H. B. Brady, 1879, Quart. Journ. Micr., vol. 19, p. 71.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4457) 0.85 mm.; thickness 0.50 mm.

Genus HASTIGERINA Wyville Thomson, 1876

HASTERIGERINA cf. PELAGICA (d'Orbigny)

Plate XIV, figs. 8a, b

Nonionina pelagica d'Orbigny, 1839, "Foraminiferes", Voyage dans l'Amerique, Meridionale, tome 5, pt. 5, p. 27.

There appears to be only one described species of Hastigerina of which these forms are not typical, the most obvious difference being a reduction in the length of the spines which ornament the surface of the test.

Maximum diameter of figured specimen (H. V. Howe Coll. No. 4458) 0.80 mm.; thickness 0.55 mm.

Genus PULLENIATINA Cushman, 1927

PULLENIATINA OBLIQUILOCULATA (Parker and Jones)

Plate XIV, figs. 9a, b

Pullenia obliquiloculata Parker and Jones, 1865, Philos. Trans., p. 368, pl. 19, fig. 4; Recent.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4459) 0.78 mm.; breadth 0.62 mm.

Genus CANDEINA d'Orbigny, 1839

CANDEINA NITIDA d'Orbigny

Plate XIV, figs. 10a, b

Candeina nitida d'Orbigny, 1839, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminiferes", p. 108, pl. 2, figs. 27, 28; Recent, Cuba.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4460) 0.50 mm.; minimum diameter 0.45 mm.

Genus ORBULINA d'Orbigny, 1839

ORBULINA UNIVERSA d'Orbigny

Plate XIV, fig. 11

Orbulina universa d'Orbigny, 1839, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminiferes", p. 3, pl. 1, fig. 1; Recent, Adriatic.

Distributed through most of the samples examined.

Diameter of hypotype (H. V. Howe Coll. No. 4461) 0.65 mm.

Family GLOBOROTALIIDAE

Genus GLOBOROTALIA Cushman, 1927

GLOBOROTALIA MENARDII (d'Orbigny)

Plate XIV, figs. 13a-c

Rotalia menardii d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 273; Modeles No. 10; Recent, Adriatic sea.

Small specimens occassionally in the inner neritic samples.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4462) 1.10 mm.; thickness 0.30 mm.

GLOBOROTALIA MENARDII FIMBRIATA (H. B. Brady)

Plate XIV, figs. 14a-c

Pulvinulina menardii d'Orbigny var. fimbriata H. B. Brady, 1884, Rep. Voy. Challenger, vol. 9, p. 691, pl. 103, figs. 3a, b.

Typical of the Atlantic forms.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4463) 1.05 mm.; thickness 0.30 mm.

GLOBOROTALIA TUMIDA (H. B. Brady)

Plate XIV, figs. 12a-c

Pulvinulina menardii d'Orbigny var. tumida H. B. Brady, 1877, Geol. Mag., vol. 4, p. 294; Quart. Journ. Micr. Sci., 1879, vol. 19, p. 80.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4465) 1.05 mm.; maximum breadth 0.80 mm.; thickness 0.50 mm.

Subgenus TRUNCOROTALIA Cushman and Bermudez, 1949

Subgenotype Rotalina truncatulinoides d'Orbigny

"Test planoconvex, thick, dorsal side flattened, ventral side sharply conical except for a large open umbilicus surrounded by the raised knobs of the inner ends of the chambers on the ventral side, periphery angular throughout; chambers not much increasing in size but rapidly in thickness as added, ventral face of the last-formed chamber above the aperture forming a concave surface." (Contr. Cushman Lab. Foram. Res., vol. 25, pt. 2, (1949), p. 35.

GLOBOROTALIA (TRUNCOROTALIA) HIRSUTA (d'Orbigny)

Plate XIV, figs. 16a-c

Rotalina hirsuta d'Orbigny, 1839, in Barker-Webb and Berthelot, Hist. Nat., Isles Canaries, vol. 2, pt. 2, "Foraminiferes", p. 131, pl. 1, figs. 37-39.

These specimens are slightly smaller but otherwise typical of forms described from the Pliocene of Cuba, plesiotype Cushman Coll. No. 47392.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4466) 0.55 mm.; thickness 0.32 mm.

GLOBOROTALIA (TRUNCOROTALIA) PUNCTULATA (d'Orbigny)

Plate XIV, figs. 17a, b

Globigerina punctulata d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 277.

The small globose form with 4 chambers in the final whorl has been described from the Recent of Cuba. The specimens from the material examined appear to be typical.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4464) 0.50 mm.; thickness 0.40 mm.

GLOBOROTALIA (TRUNCOROTALIA) TRUNCATULINOIDES (d'Orbigny)

Plate XIV, figs. 15a-c

Rotalina truncatulinoides d'Orbigny, 1839, in Barker-Webb and Berthelot, Hist. Nat., Isles Canaries, vol. 2, pt. 2, "Foraminiferes", p. 132, pl. 2, figs. 25-27.

Typical of the Gulf of Mexico-Carribean form currently being assigned to this species.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4467) 0.70 mm.; thickness 0.50 mm.

Family CASSIDULINIDAE

Genus CASSIDULINA D'Orbigny, 1826

CASSIDULINA LAEVIGATA d'Orbigny

Plate XV, figs. 2a-c

Cassidulina laevigata d'Orbigny, 1826, Ann. Sci. Nat., p. 282, pl. 15, figs. 4, 5.

These are typical of a few of the numerous forms assigned to this species.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4468) 0.46 mm.; thickness 0.14 mm.

CASSIDULINA LAEVIGATA CARINATA Cushman

Plate XV, figs. 1a, b

Cassidulina laevigata d'Orbigny var. carinata Cushman, 1922, U. S. Nat. Mus., Bull. 104, pt. 3, p. 124, pl. 25, figs. 6, 7.

Compared with holotype (U.S.N.M. Cat. No. 16375) from Ragged Key, Florida.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4469) 0.27 mm.; thickness 0.12 mm.

CASSIDULINA SUBGLOBOSA H. B. Brady

Plate XV, figs. 3a, b

Cassidulina subglobosa H. B. Brady, 1884, Rep. Voy. Challenger, Zool., vol. 9, p. 430, pl. 54, fig. 17.

This is the C. subglobosa of the Miocene, Bluff Bay, Jamaica.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4470) 0.28 mm.; thickness 0.18 mm.

Genus CASSIDULINOIDES Cushman, 1927

CASSIDULINOIDES MEXICANA (Cushman)

Plate XV, figs. 4a, b

Cassidulina mexicana Cushman, 1922, U. S. Nat. Mus., Bull. 104, pt. 3, p. 131, pl. 24, fig. 5.

These specimens lack the compressed chambers of C. bradyi (Norman).

Length of hypotype (H. V. Howe Coll. 4471) 0.40 mm.; maximum

thickness 0.18 mm.

Genus PSEUDOPARRELLA Cushman and ten Dam, 1948

PSEUDOPARRELLA HOWEI Andersen, n. sp.

Plate XV, figs. 5a-c

Test small with a very rounded appearance when viewed from the side; typically with 6 chambers in the final whorl which gradually increase in size as added, the last 3 or 4 being somewhat inflated. The sutures are distinct, depressed and form an acute angle with the periphery on the dorsal side; the ventral side with sutures nearly radially disposed. The periphery is slightly rounded in end view, and slightly lobulate when viewed from the side. The aperture, an elongate slit paralleling the plane of coiling lies on the ventral side of the periphery and extends the full length of the apertural face. Wall of test is unornamented, finely perforate and transparent. Maximum diameter of holotype (H. V. Howe Coll. No. 4472) 0.23 mm.; thickness 0.10 mm.

This species can be distinguished from P. exiqua (H. B. Brady) by its rounder periphery and lack of "thickened lines" on the dorsal side of the test. It differs from P. bradyana (Cushman) in its rounded periphery, few chambers per whorl and lack of any tooth-like projection in the aperture.

P. howei n. sp. occurs in vast quantities in the inner neritic sediments. It is present but not in great abundance in some of the mudlump clay. It is named in honor of Dr. H. V. Howe, Director, School of Geology, Louisiana State University.

Family CHILOSTOMELLIDAE

Genus CHILOSTOMELLA Reuss, 1850

CHILOSTOMELLA OOLINA Schwager

Plate XV, figs. 6a, b

Chilostomella oolina Schwager, 1878, Boll. Co., geol. Ital., vol. 9, p. 527, pl. 1, fig. 16.

Figured form shows the maximum inflation of any specimen in the hypodigm.

Length of hypotype (H. V. Howe Coll. No. 4473) 0.40 mm.; maximum breadth 0.26 mm.

Genus PULLENIA Parker and Jones, 1862

PULLENIA BULLOIDES (d'Orbigny)

Plate XV, figs. 8a, b

Nonionina bulloides d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 293; Foram. Foss. Bass. Tert. Vienne, 1846, p. 107, pl. 5, figs. 9, 10; Tert. Vienne, Austria.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4474) 0.32 mm.; thickness 0.22 mm.

PULLENIA QUINQUELOBA (Reuss)

Plate XV, figs. 7a, b

Nonioniana quinqueloba Reuss, 1851, Zeitschr. deutsch. geol. Ges., vol. 3, p. 71, pl. 5, fig. 31, Oligocene, Germany.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4475) 0.49 mm.; thickness 0.24 mm.

Genus SPHAEROIDINA d'Orbigny, 1826

SPHAEROIDINA BULLOIDES d'Orbigny

Plate XV, figs. 9a, b

Sphaeroidina bulloides d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 267, Modeles No. 65.

Compared with topotype (Cushman Coll. No. 59393) from beach sand, Rimini, Italy.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4476) 0.50 mm.

Family ANOMALINIDAE

Genus PLANULINA d'Orbigny, 1826

PLANULINA FAVEOLATA (H. B. Brady)

Plate XV, figs. 10a-c

Anomaline faveolata H. B. Brady, 1884, Rep. Voy. Challenger, Zool., vol. 9, p. 673, pl. 94, fig. 1.

Characteristic of the form currently being assigned to this species.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4477) 0.90 mm.; thickness 0.20 mm.

PLANULINA MERA Cushman

Plate XV, figs. 11a-c

Planulina mera Cushman, 1944, Contr. Cushman Lab. Foram. Res., Spec. Pub. No. 12, p. 36, pl. 4, fig. 25.

Length of hypotype (H. V. Howe Coll. No. 4478) 0.66 mm.; thickness 0.20 mm.

Genus CIBICIDES Montfort, 1808

CIBICIDES FLORIDANA (Cushman)

Plate XV, figs. 12a-c

Truncatulina floridana Cushman, 1918, U. S. Geol. Surv., Bull. 676, p. 62, pl. 19, figs. 2a-c.

The holotype of C. floridana could not be located, the paratypes were broken. The identification of these specimens in the writer's collection is based on comparison with Cushman's plesiotypes No. 21653 (U. S. Nat. Mus., Bull. 104, pt. 8, pl. 23, fig. 3) and No. 4464 (Spec. Pub. 15, pl. 12, fig. 8).

Maximum diameter of hypotype (H. V. Howe Coll. No. 4479) 0.70 mm.; thickness 0.29 mm.

CIBICIDES sp. "A"

Plate XV, figs. 13a-c

These specimens have been identified as Anomalina ornata, an assignment with which the writer is not in accord. There is every reason to believe they are related to C. floridana (fig. 12) and may even be the microspheric form. The only difference between the two groups is that Cibicides sp. "A" is slightly larger in diameter, thicker and has a more rounded periphery. The architecture of the two tests is identical.

Maximum diameter of figured specimen (H. V. Howe Coll. No. 4480) 0.85 mm.; thickness 0.43 mm.

Genus CIBICIDINA BANDY, 1949

Genotype Cibicidina walli Bandy

"Test free, rotaloid, dorsal spire nearly or quite concealed by the involute last whorl, only the last whorl visible on the ventral side; ventral side convex to conical and sometimes umbilicate, dorsal side flat to concave; chambers numerous, closely appressed; edge sharp or bluntly angled; wall hyaline, medium to finely perforate, smooth or with limbate sutures or secondary thickening and papillae, sometimes with central bosses; aperture a small arched opening at the base of the last septal face in the plane of coiling, extending under the involute dorsal flap of the last chamber. Diameter up to about 1.00 mm. Common.

"This planoconvex genus differs from Cibicides in the involute character of the dorsal side and in the finer perforations. Anomalina differs in lacking the dorsal aperture, having a rounded back, and being more evolute dorsally. Discorbis lacks the dorsal aperture and the involute character of the dorsal side." (Orville L. Bandy, 1949, Pal. Res. Inst., Bull. Amer. Pal., vol. 32, p. 91.)

CIBICIDINA cf. CONCENTRICA (Cushman)

Plate XV, figs. 14a-c

Truncatulina concentrica Cushman, 1918, U. S. Geol. Surv., Bull. 676, p. 64, pl. 21, fig. 3.

These specimens have much more limbate sutures than Cushman's paratype (Cushman Coll. No. 2878) but appear to be typical of other plesiotypes assigned to C. concentrica.

Maximum diameter of figured specimen (H. V. Howe Coll. No. 4481) 0.85 mm.; thickness 0.30 mm.

Family PLANORBULINIDAE

Genus PLANORBULINA d'Orbigny, 1826

PLANORBULINA MEDITERRANIENSIS d'Orbigny

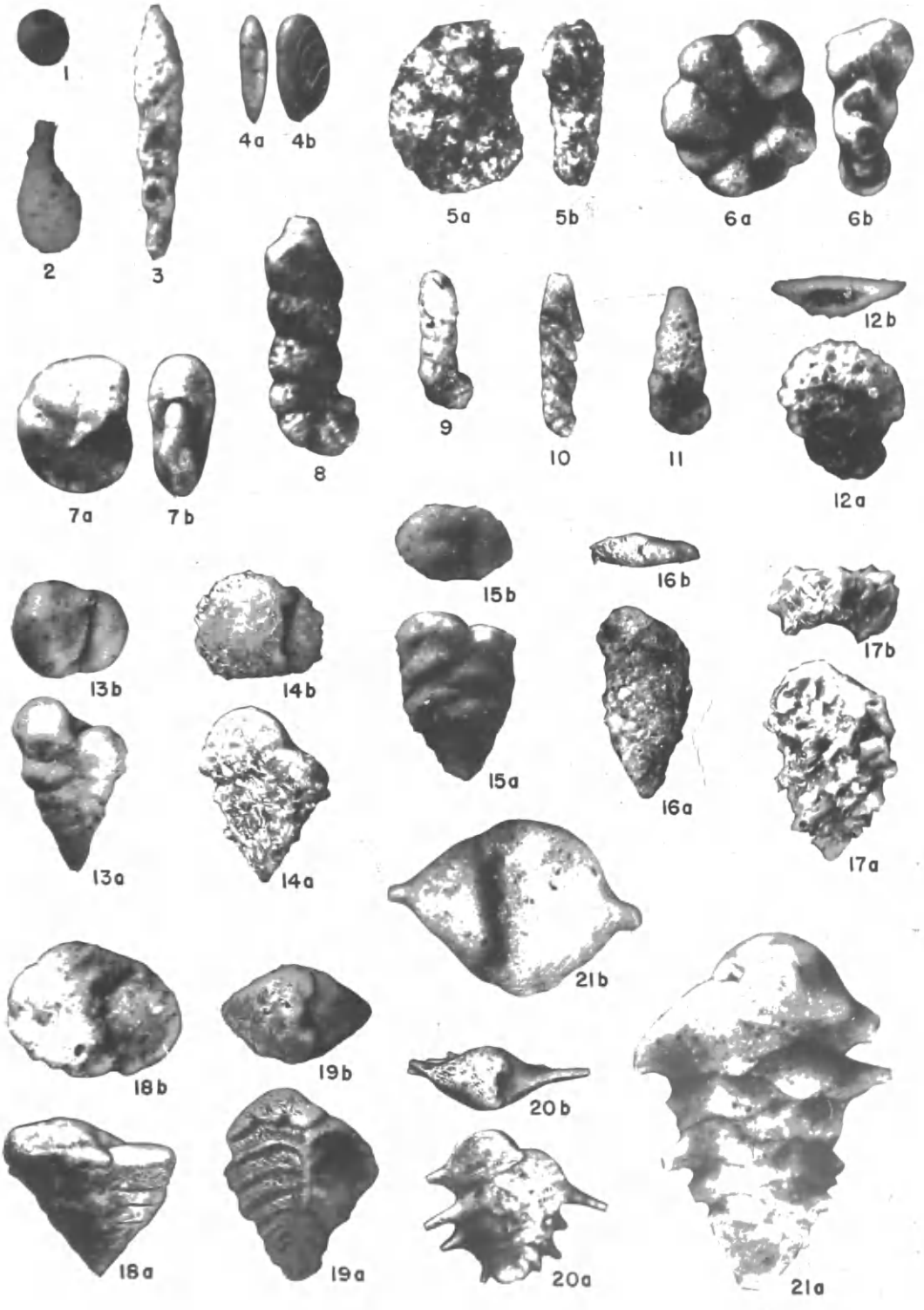
Plate XV, figs. 15a, b

Planorbulina mediterraniensis d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 280, no. 23, pl. 14, figs. 4-6.

Maximum diameter of hypotype (H. V. Howe Coll. No. 4482) 1.00 mm.

EXPLANATION OF PLATE I

PLATE I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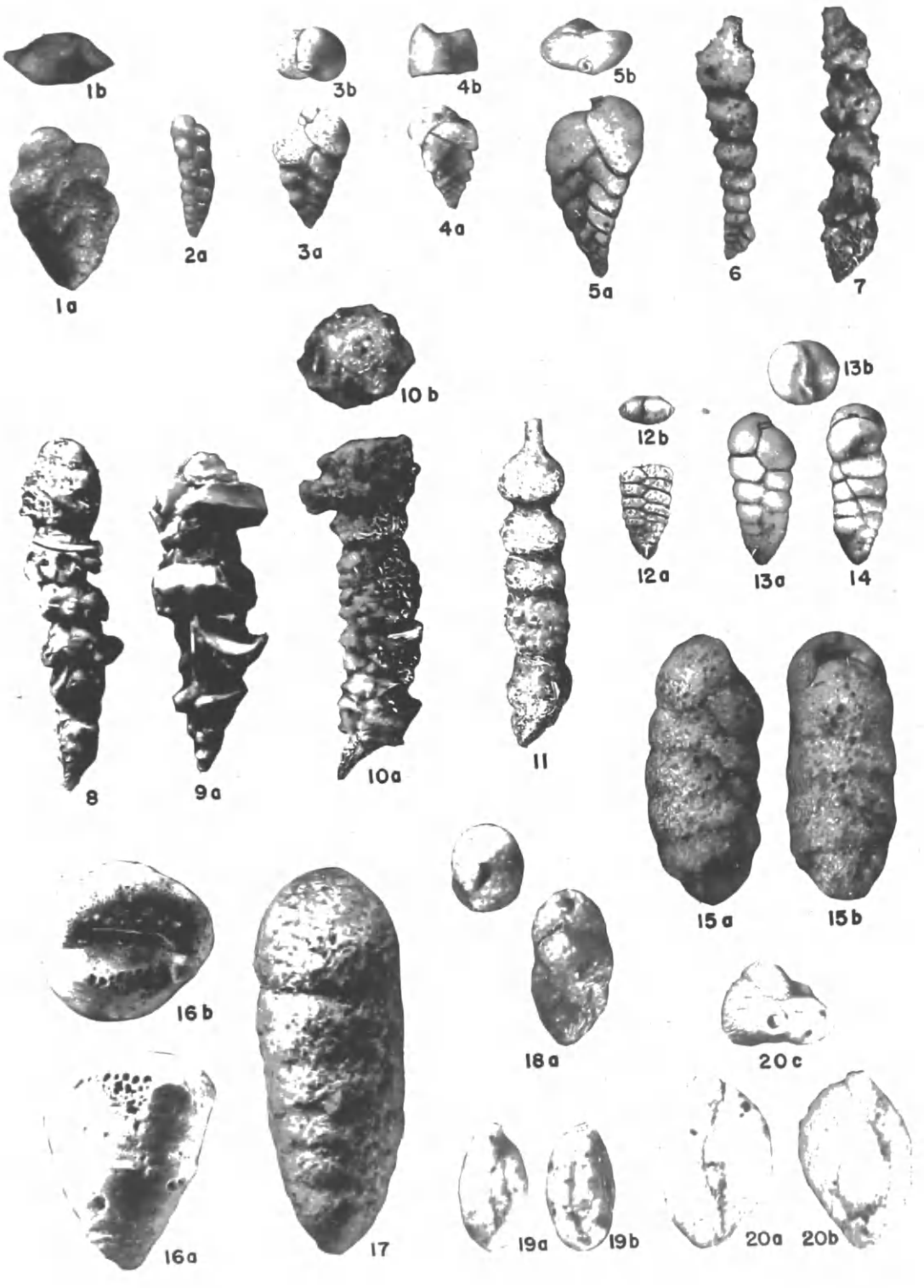
EXPLANATION OF PLATE II

PLATE II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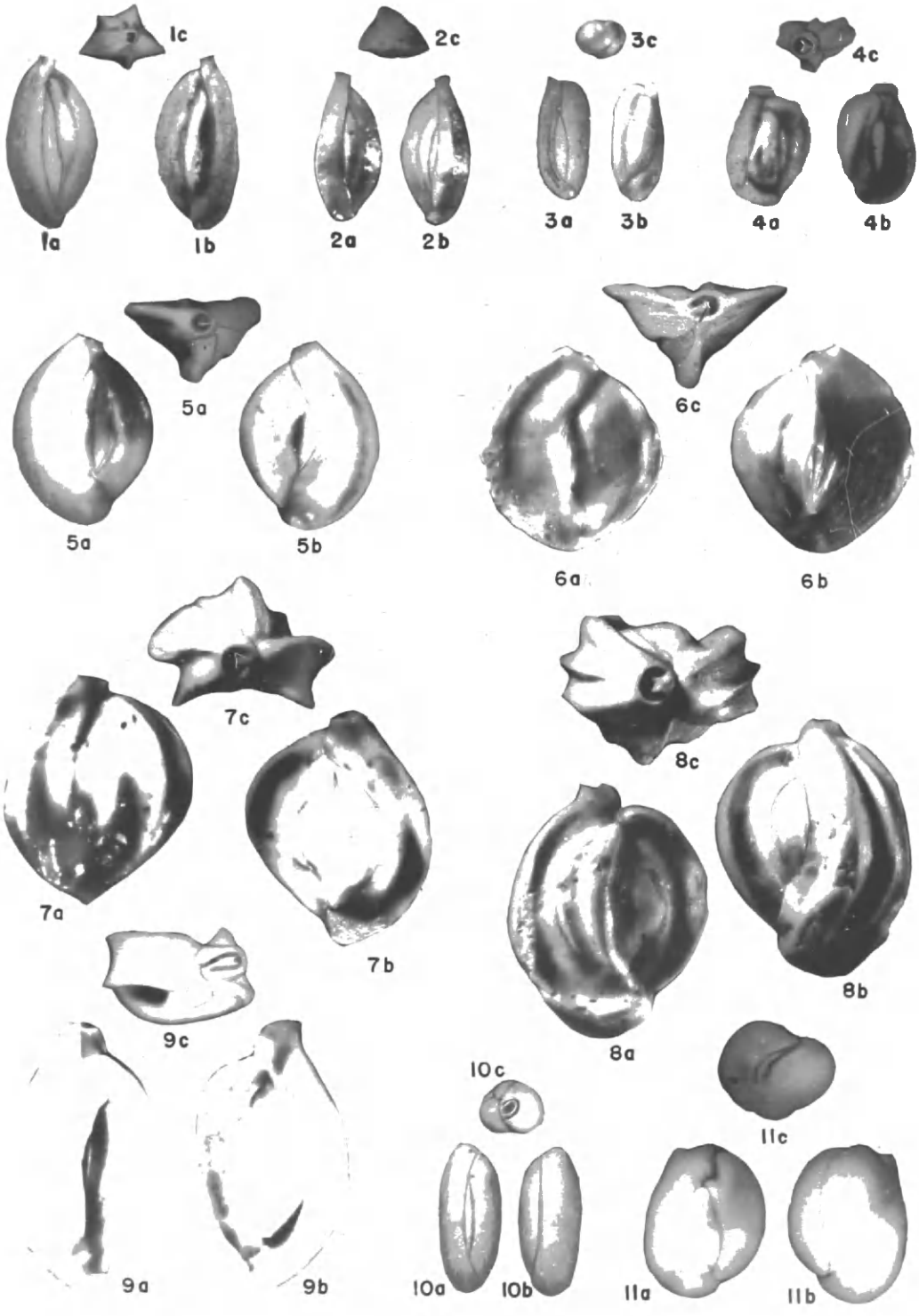
EXPLANATION OF PLATE III

Fig. — Page

1. Quinqueloculina candeiana d'Orbigny. X 30. a, b, opposite sides; c, apertural view. 45
2. Quinqueloculina glabrata Cushman. X 30. a, b, opposite sides; c, apertural view. 46
3. Quinqueloculina burrwoodensis Andersen, n. sp. X 30. a, b, opposite sides; c, apertural view. 45
4. Quinqueloculina porteadsensis Andersen, n. sp. X 30. a, b, opposite sides; c, apertural view. 48
5. Quinqueloculina cf. lamarkiana d'Orbigny. X 30. a, b, opposite sides; c, apertural view. 46
6. Quinqueloculina cf. lamarkiana d'Orbigny. X 30. a, b, opposite sides; c, apertural view. 46
7. Quinqueloculina cf. bicostata d'Orbigny. X 30. a, b, opposite sides; c, apertural view. 44
8. Quinqueloculina sp. "B". X 30. a, b, opposite sides; c, apertural view. 50
9. Massilina southpassensis Andersen, n. sp. X 30. a, b, opposite sides; c, apertural view. 52
10. Miliolinella porteadsensis Andersen, n. sp. X 30. a, b, opposite sides; c, apertural view. 51
11. Miliolinella claifornica Rhumbler. X 30. a, b, opposite sides; c, apertural view. 50

PLATE III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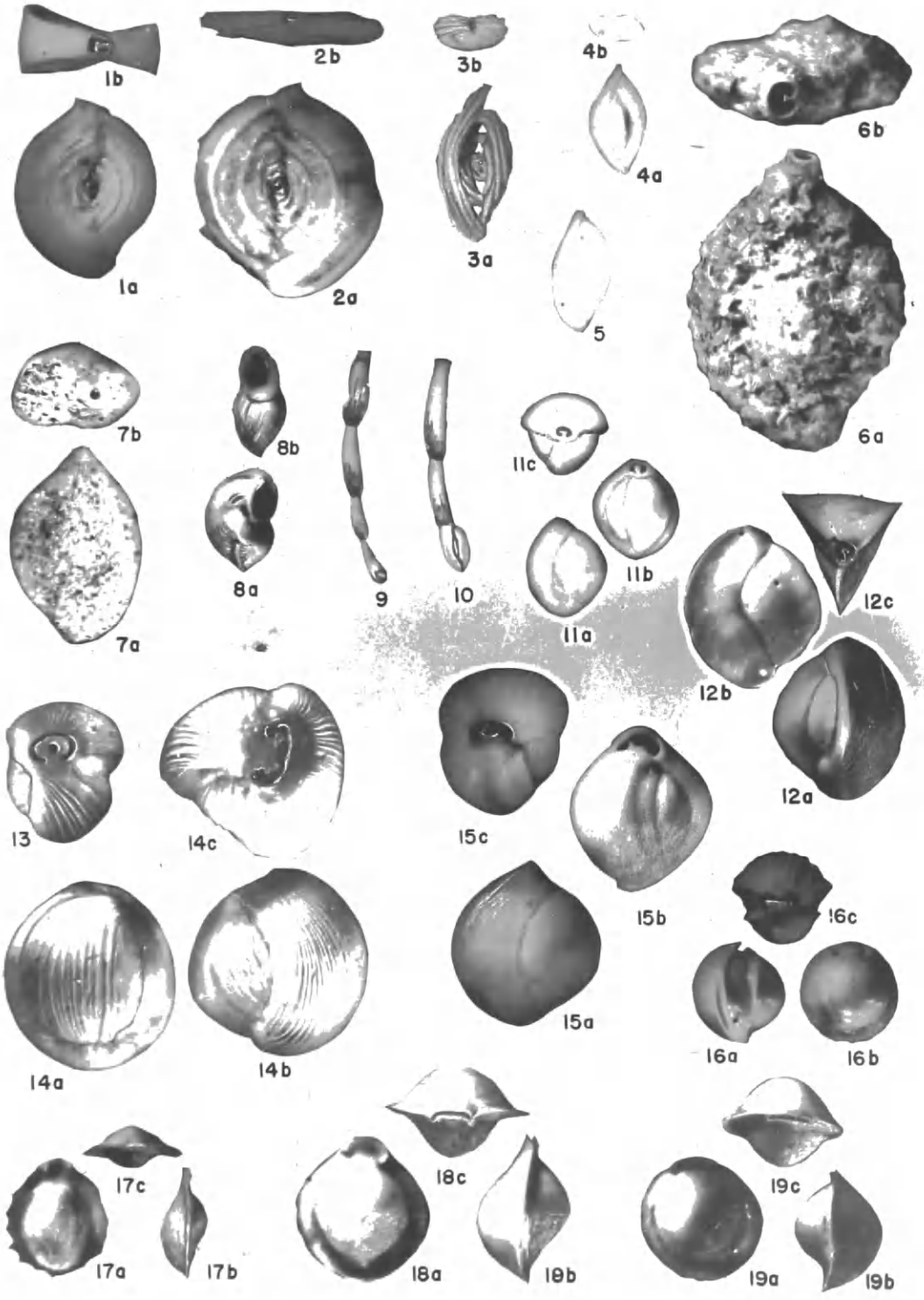
EXPLANATION OF PLATE IV

Fig. — Page

1. Spiroloculina southpassensis Andersen, n. sp. X 30. a, side view; b, apertural view. 53
2. Spiroloculina sp. "A". X 30. a, side view; b, apertural view. 54
3. Spiroloculina cf. antillarium d'Orbigny. X 30. a, side view; b, apertural view. 53
4. Sigmoilina tenuis (Czjzek). X 50. a, side view; b, apertural view. 55
5. Sigmoilina tenuis (Czjzek). X 50. Side view. 55
6. Sigmoilina cf. flintii Cushman. X 30. a, side view; b, apertural view. 54
7. Sigmoilina schlumbergeri A. Silvestri. X 30. a, side view; b, apertural view. 55
8. Articulina cf. mucronata (d'Orbigny). X 40. a, side view; b, apertural view. 56
9. Articulina mayori Cushman. X 40. 56
10. Articulina mayori Cushman. X 30. 56
11. Triloculina cf. striatotrigonula Parker and Jones. X 40. a, b, opposite sides; c, apertural view. 57
12. Triloculina tricarinate d'Orbigny. X 30. a, b, opposite sides; c, apertural view. 58
13. Triloculina insignis (H. B. Brady). X 30. Apertural view. . 57
14. Triloculina insignis (H. B. Brady). X 30. a, b, opposite sides; c, apertural view. 57
15. Triloculina trigonula (Lamarck). X 30. a, b, opposite sides; c, apertural view. 58
16. Pyrgo sp. "A". X 30. a, b, opposite sides; c, apertural view. 61
17. Pyrgo nasutus Cushman. X 30. a, side view; b, peripheral view; c, apertural view. 59
18. Pyrgo nasutus southpassensis Andersen, n. var. X 30. a, side view; b, peripheral view; c, apertural view. .. 60
19. Pyrgo nasutus balizensis Andersen, n. var. X 30. a, side view; b, peripheral view; c, apertural view. 60

PLATE IV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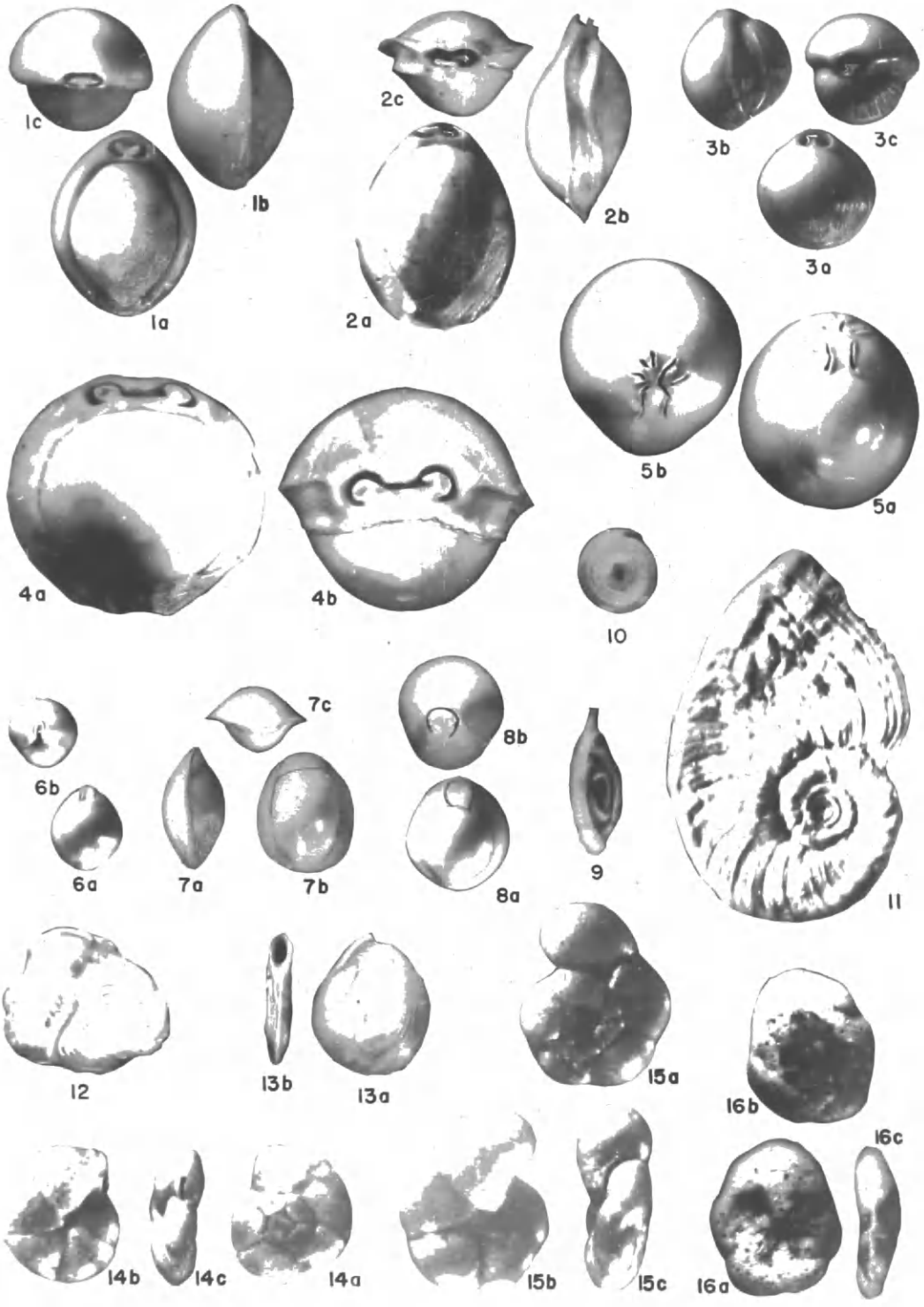
EXPLANATION OF PLATE V

Fig. — Page

1. Pyrgo cf. elongata d'Orbigny. X 30. a, front view; b, peripheral view; c, apertural view. 59
2. Pyrgo cf. carinata (d'Orbigny). X 30. a, front view; b, peripheral view; c, apertural view. 58
3. Pyrgo subsphaerica burrwoodensis Andersen, n. var. X 30. a, front view; b, peripheral view; c, apertural view. . 60
4. Pyrgo vespertilio (Schlumberger). X 20. a, front view; b, apertural view. 61
5. Pyrgoella sphaera (d'Orbigny). X 30. a, front view; b, apertural view. 61
6. Biloculinella ? sp. "A". X 30. a, front view; b, apertural view. 62
7. Biloculinella labiata (Schlumberger) X 50. a, peripheral view; b, front view; c, apertural view. 62
8. Biloculinella toddae Andersen, n. name. X 30. a, front view; b, peripheral view. 62
9. Spirophthalmidium sp. "A". X 50. Side view. 64
10. Cornuspira planorbis Schultz. X 50. Side view. 63
11. Cornuspiroides foliaceum (Philippi). X 15. Side view. 63
12. Nodobacullariella antlantica Cushman and Hanzawa. X 30. Side view. 64
13. Nodobacullariella sp. "A". X 30. a, side view; b, peripheral view. 65
14. Arenoparrella mexicana (Kornfeld). X 40. a, dorsal view; b, ventral view; c, peripheral view. 66
15. Trochammina inflata (Montagu). X 40. a, dorsal view; b, ventral view; c, peripheral view. 65
16. Trochammina cf. rotaliformis J. Wright. X 40. a, dorsal view; b, ventral view; c, peripheral view. 65

PLATE V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EXPLANATION OF PLATE VI

Fig. — Page

1. Robulus balizensis Andersen, n. sp. X 25. a, side view; b, apertural view. 69
2. Robulus cf. clericii (Fornasini). X 25. a, side view; b, apertural view. 74
3. Robulus cf. serpens (Sequenza). X 25. a, side view; b, apertural view. 80
4. Robulus cf. cultratus Montfort. X 25. a, side view; b, apertural view. 75
5. Robulus calcar (Linne). X 25. a, side view; b, apertural view. 72
6. Robulus calcar southpassensis Andersen, n. var. X 25. a, side view; b, apertural view. 73
7. Robulus iotus (Cushman) X 18. a, side view; b, apertural view. 76
8. Robulus porteadsensis Andersen, n. sp. X 18. a, side view; b, apertural view. 78
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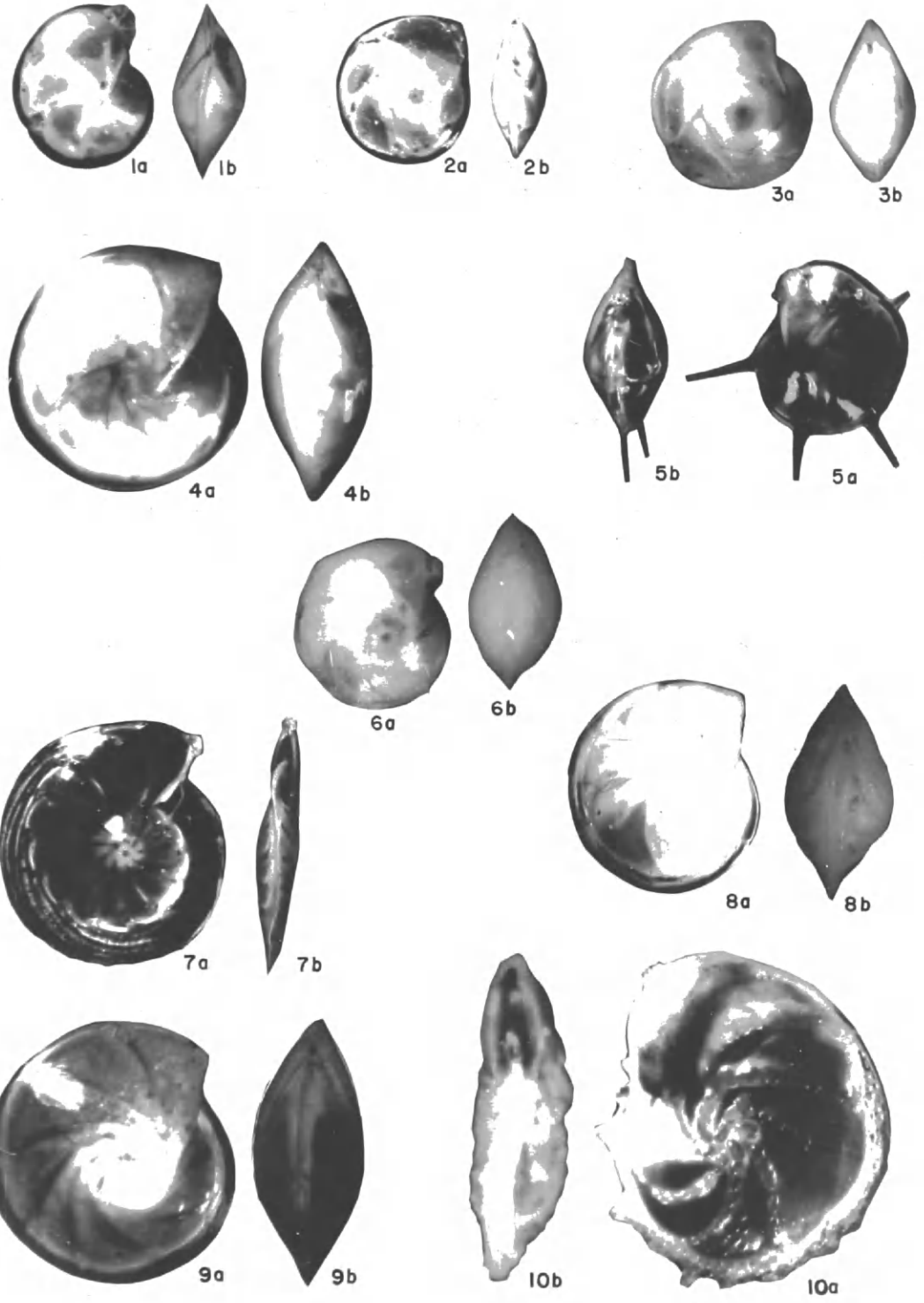

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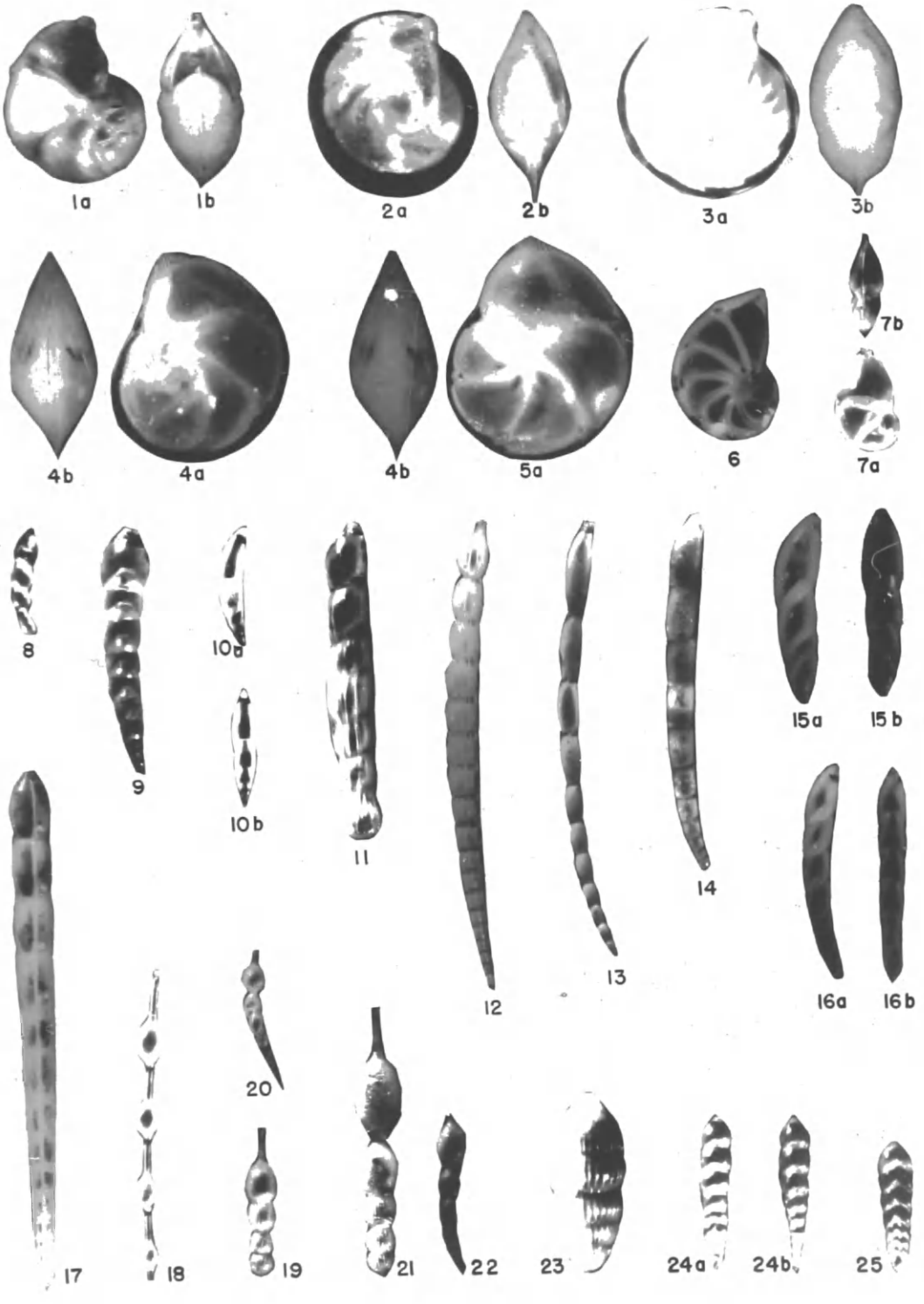
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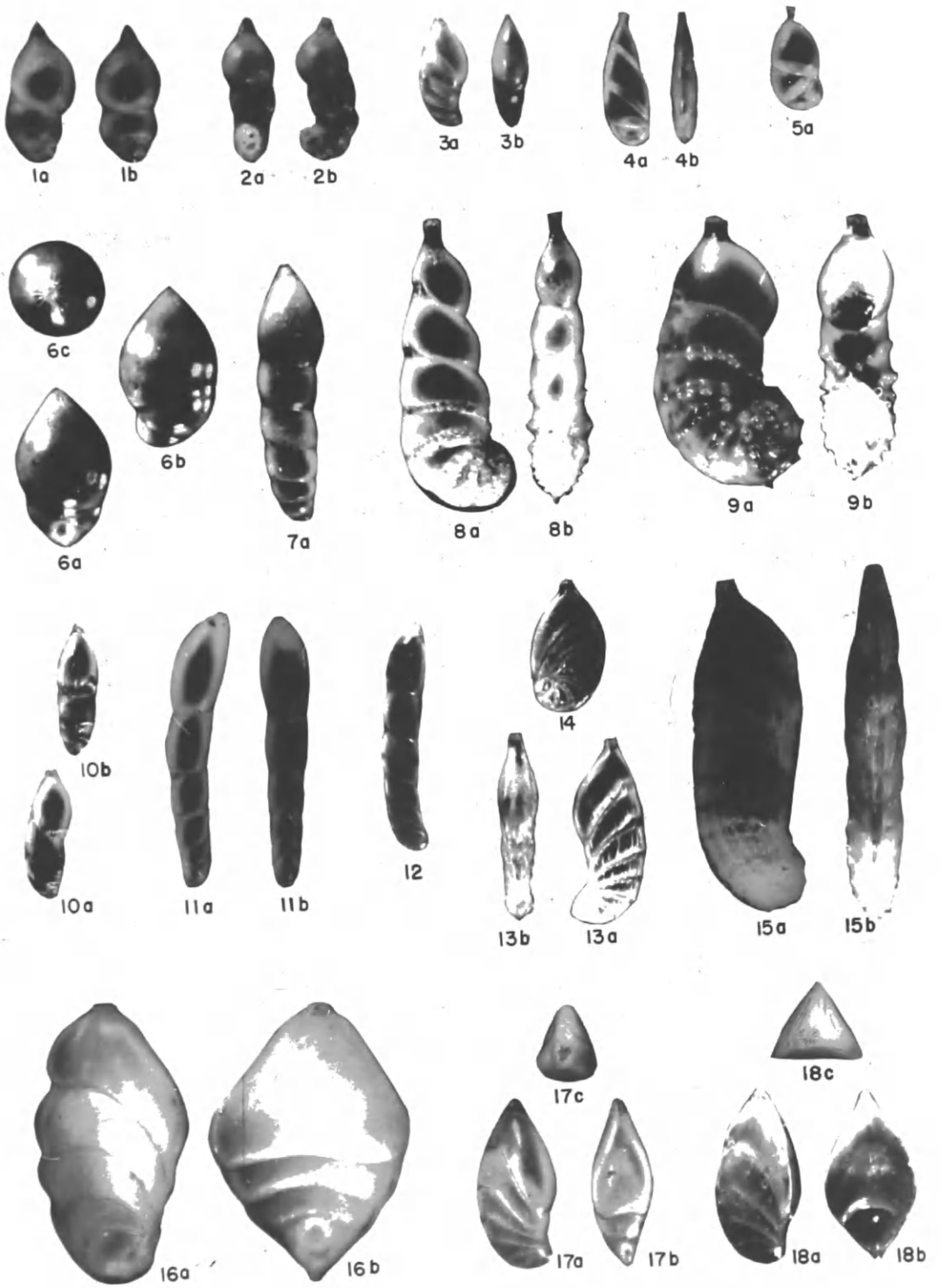
EXPLANATION OF PLATE VIII

PLATE VIII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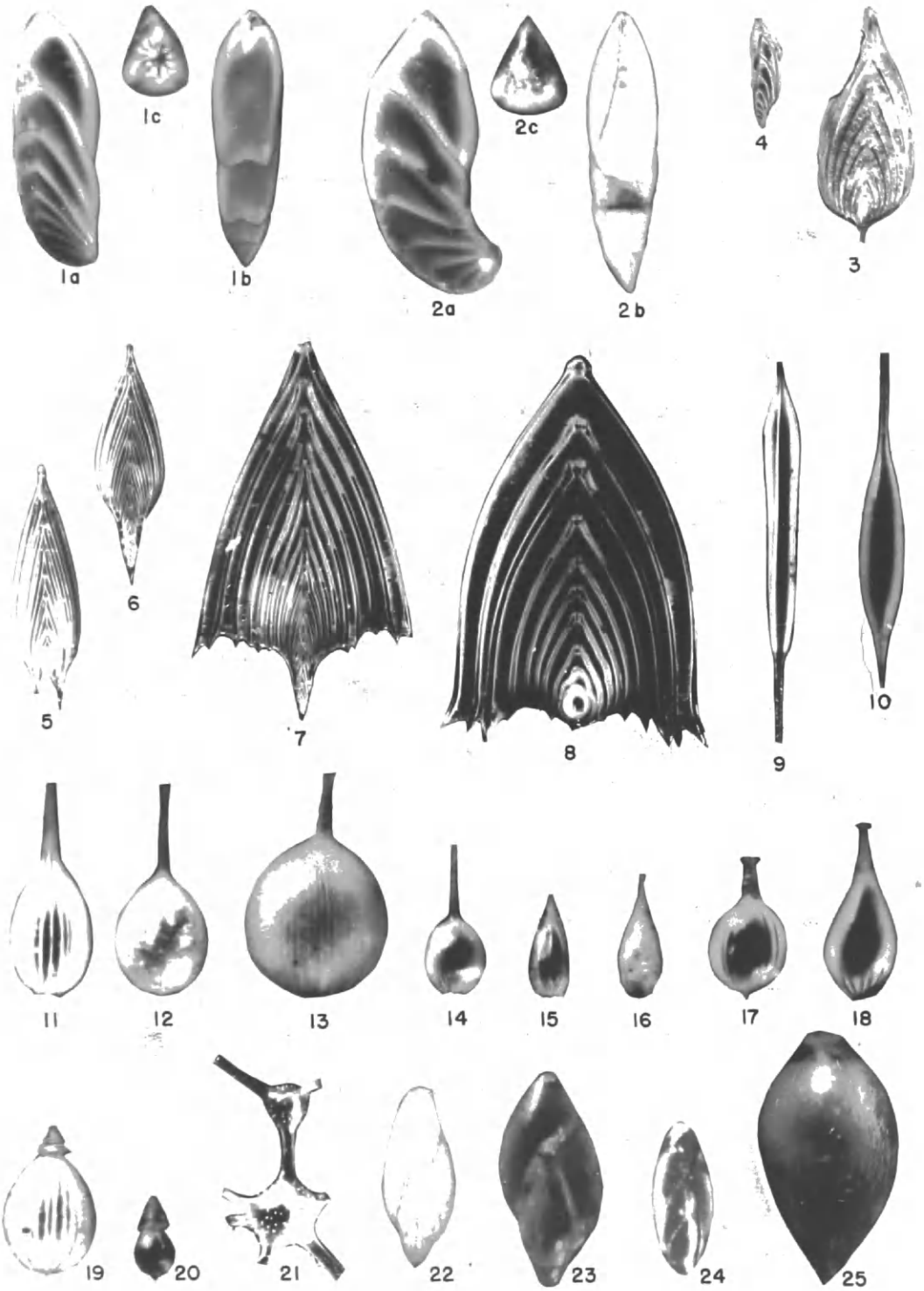
EXPLANATION OF PLATE IX

PLATE IX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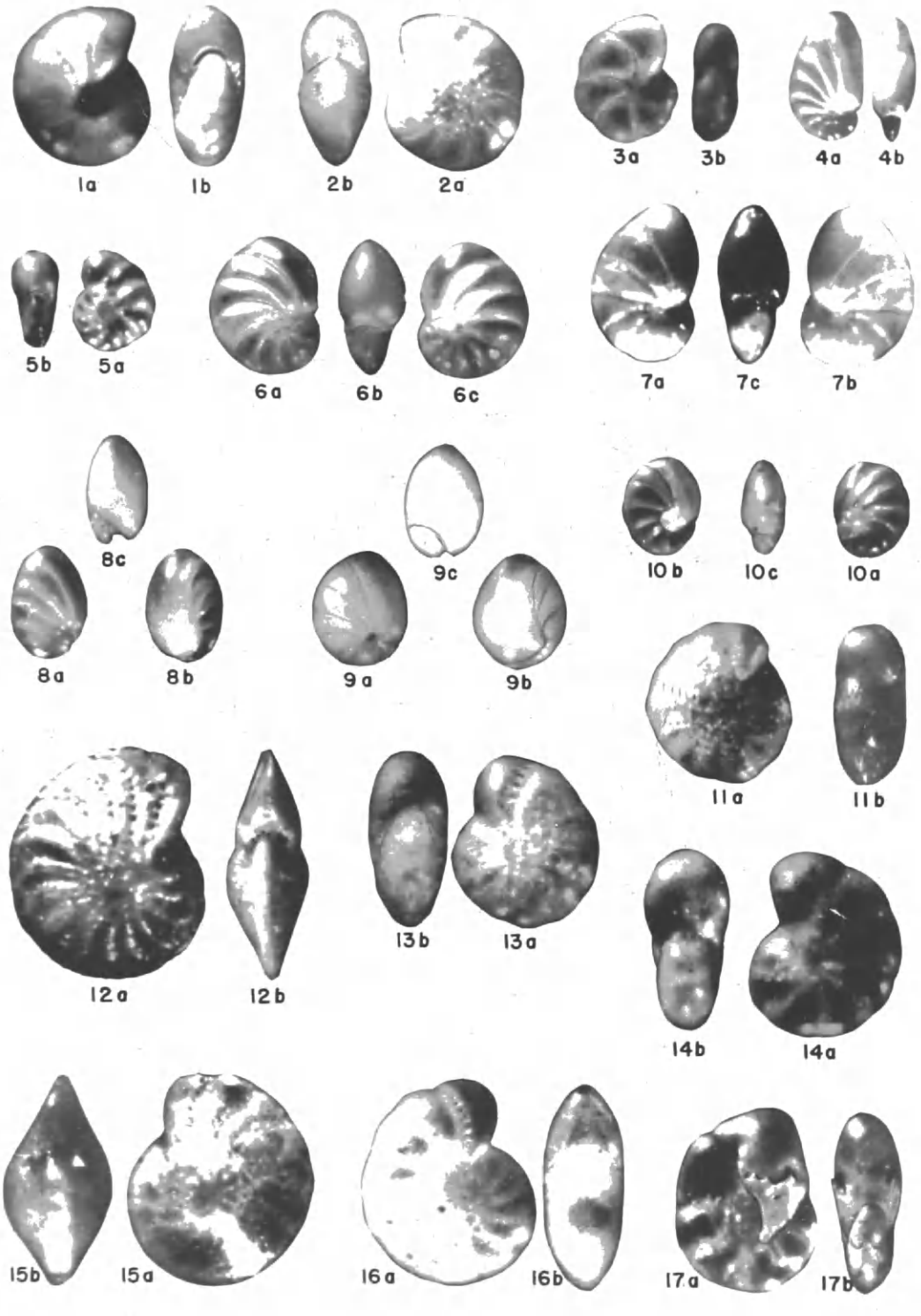
EXPLANATION OF PLATE X

PLATE X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EXPLANATION OF PLATE XI

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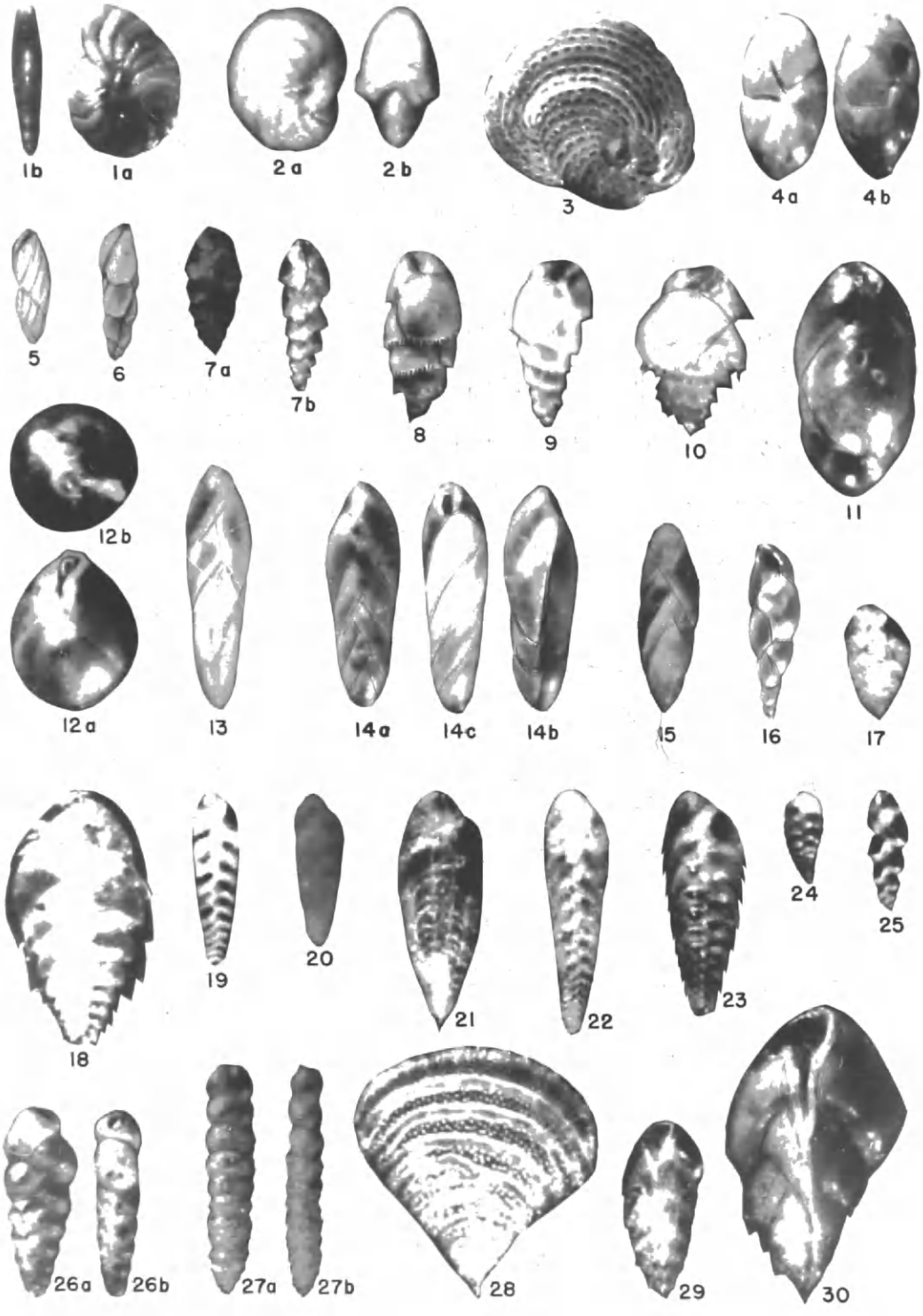
PLATE XI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EXPLANATION OF PLATE XI Cont'd.

EXPLANATION OF PLATE XII

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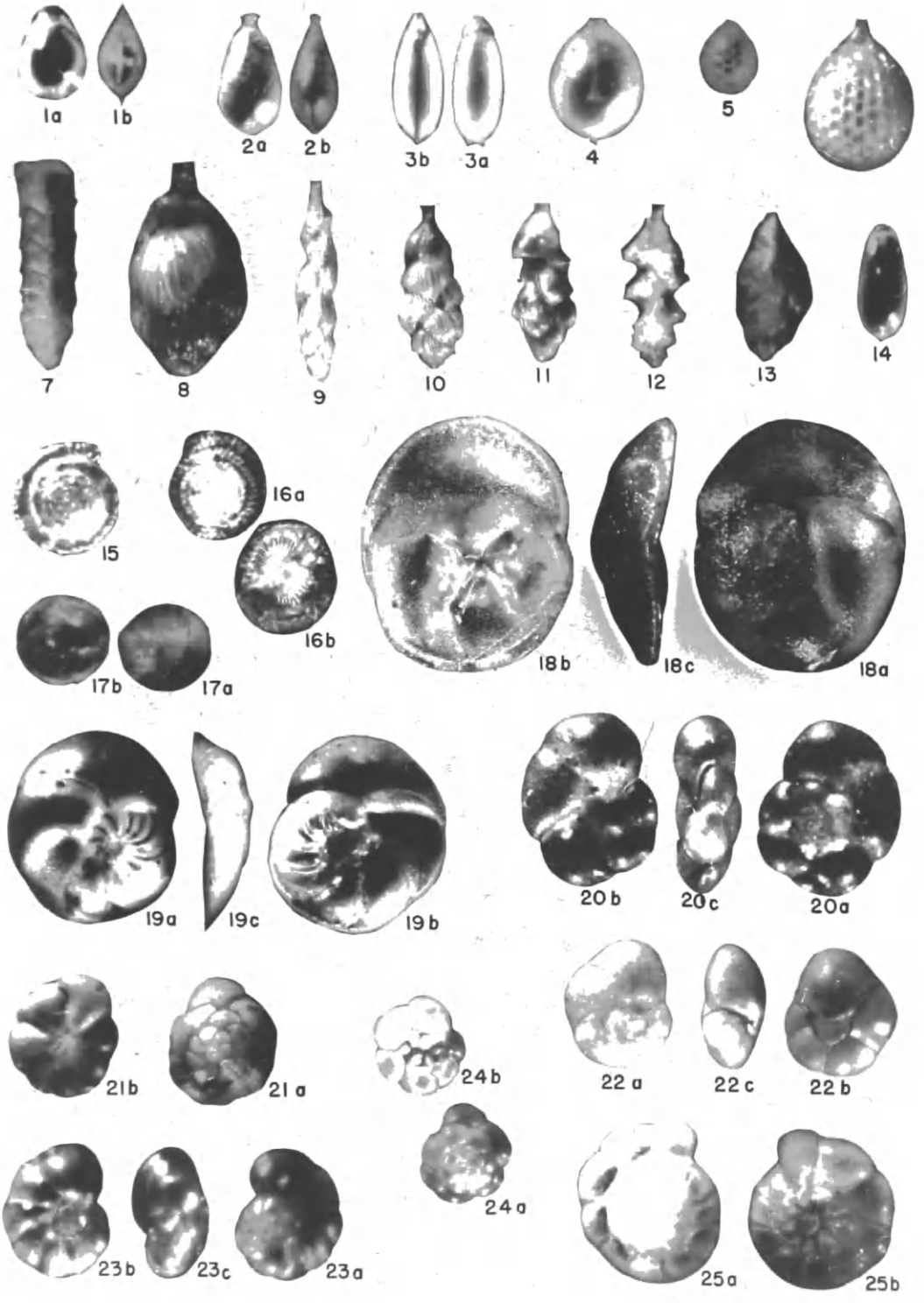
PLATE XII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EXPLANATION OF PLATE XII Cont'd.

EXPLANATION OF PLATE XIII

PLATE XIII

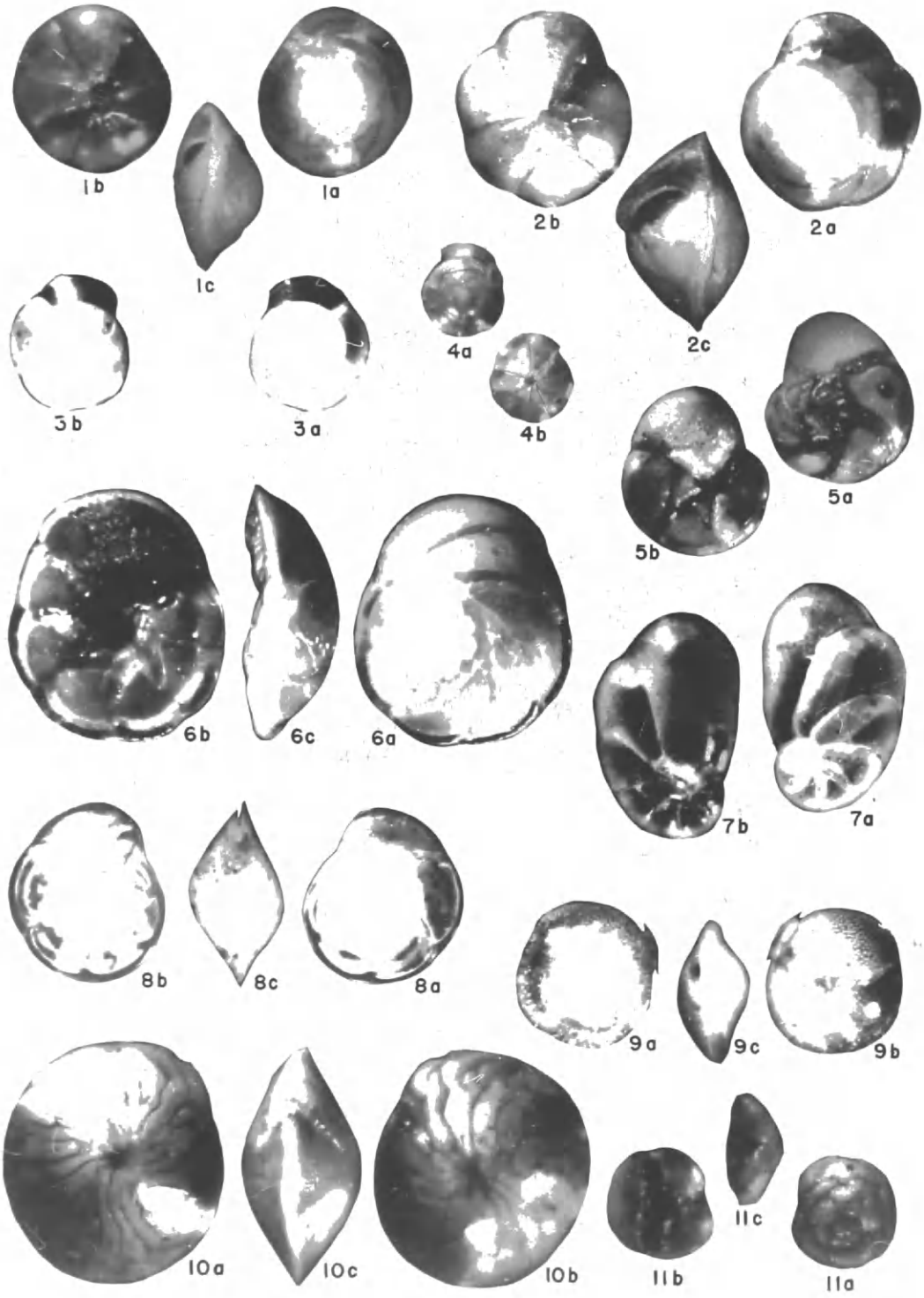
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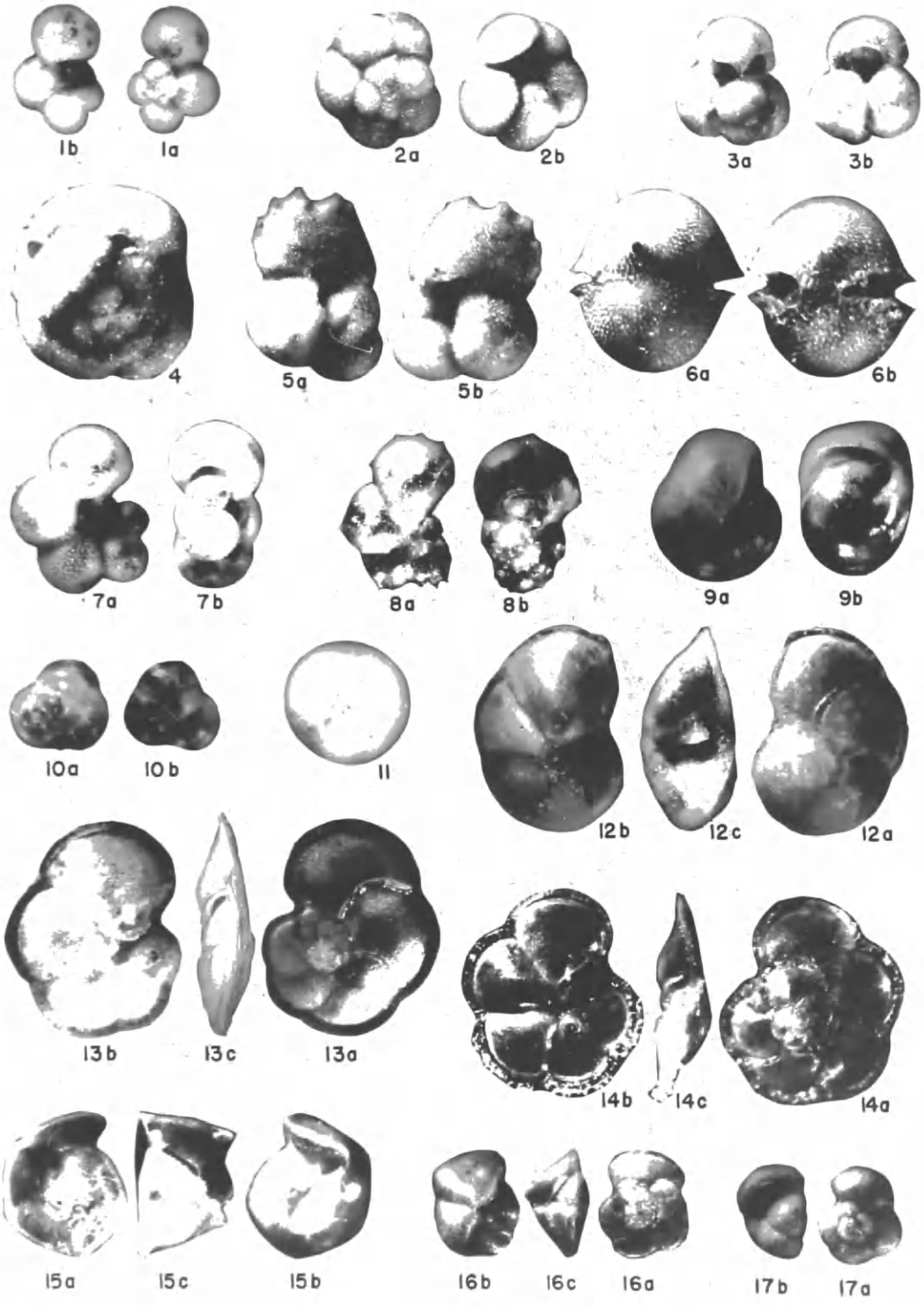
PLATE XIV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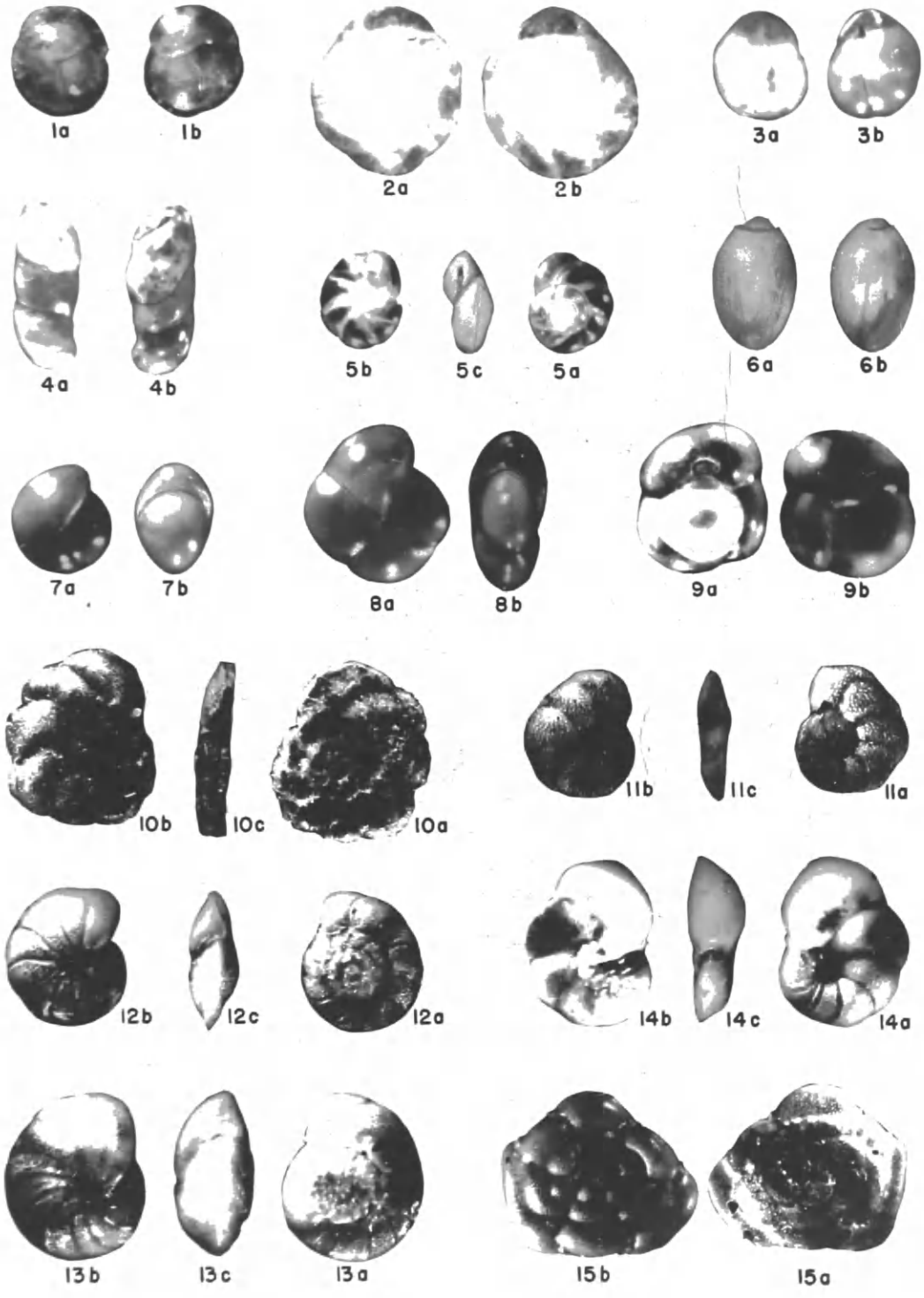
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AUTOBIOGRAPHY

Harold V. Andersen was born in Cumberland, Iowa, November 12, 1907. At the age of three he moved to Yuma, Colorado, where twelve years of primary education were completed. In 1925, following graduation from Yuma High School, he entered the University of Denver on a one year scholarship. Formal education was interrupted until the fall of 1930 when he enrolled at the University of Nebraska, where, after additional interruptions during the depression, he finally received his B. A. degree with a major in geology in February, 1940. He was admitted to the University of Nebraska Graduate School in 1940. From 1940 until December, 1942 he was State Director of the archaeological investigations in Alabama conducted under the joint sponsorship of the Works Progress Administration and Alabama Geological Survey. In 1946, following a three and one-half year tenure with the Corps of Engineers during World War II, he was admitted to Louisiana State University for graduate work in geology. In 1947 he was raised to the status of Instructor in the geology department and promoted to Assistant Professor in 1950.

He married Dorothy Elizabeth Sharp at Tuscumbia, Alabama, November 26, 1938.

APPENDIX I

Collection Localities

1. Location: N28°58'47"Lat. W89°25'37"Long.
   Tidal channel in Stake Island, right side of Southwest Pass; depth of water 3 feet; core sample recovered.
2. Location: N28°58'41"Lat. W89°25'46"Long.
   Tidal channel in Stake Island south of location 1; depth of water 4 feet; 6-inch core sample recovered.
3. Location: N28°57'53"Lat. W89°26'48"Long.
   Embayment at mouth of tidal channel, west side of Stake Island; depth of water 2 feet; 6-inch core sample recovered.
4. Location: N28°57'24"Lat. W89°26'57" Long.
   Shell beach at northern margin of Mud Bay, west side of Stake Island; surface sample collected.
5. Location: N28°56'52"Lat. W89°24'40"Long.
   Beach 1 mile south of Burrwood, Louisiana, left bank of Southwest Pass. Collected by Dr. H. N. Fisk in 1948.
6. Location: N28°58'20"Lat. W89°24'21"Long.
   Burrwood Bayou, left bank of Southwest Pass; depth of water 5 feet; grab sample recovered.
7. Location: N29°05'16"Lat. W89°18'28"Long.
   Joseph Bayou near point of divergence from left bank of Southwest Pass; depth of water 7 feet; 3-inch core sample recovered.

8. Location: N29°03'54"Lat. W89°17'30"Long.
   Distributary of Joseph Bayou near outlet into East Bay; depth of water approximately 3 feet; 6-inch core of bottom sediment recovered.

9. Location: N29°03'49"Lat. W89°17'39"Long.
   Joseph Bayou, right bank of stream near outlet into East Bay; depth of water 3 feet; 10-inch core recovered.

10. Location: N29°03'49"Lat. W89°17'39"Long.
    Joseph Bayou, center of stream near outlet into East Bay; depth of water 8 feet; 8-inch core of bottom sediment recovered.

11. Location: N29°00'46"Lat. W89°11'34"Long.
    Port Eads Canal, southern end of waterway near outlet into Garden Island Bay; depth of water 4 feet; 3-inch core of bottom sediment recovered.

12. Location: N29°01'11"Lat. W89°12'04"Long.
    Port Eads Canal, northern end near entrance from South Pass; depth of water 6 feet; 4-inch core of bottom sediment recovered.

13. Location: N29°01'27"Lat. W89°12'32"Long.
    Unnamed bayou north of Port Eads near point of divergence from South Pass; depth of water 9 feet; 6-inch core of bottom sediment recovered.

14. Location: N29°07'07"Lat. W89°14'28"Long.
    Dennis Pass near point of divergence from Pass a Loutre; depth of water 2.5 feet; bottom sample recovered.

15. Location: N29°07'15"Lat. W89°12'32"Long.
Dennis Pass near Pass a Loutre Club house. Grab sample recovered.

16. Location: N29°06'02"Lat. W89°11'33"Long.
Bayou which connects Loomis Pass with Johnson Pass sampled at northern end; depth of water 12 feet; 6-inch core of bottom sediment recovered.

17. Location: N29°05'16"Lat. W89°11'01"Long.
Johnson Pass, inland; depth of water 12 feet; 8-inch core of bottom sediment recovered.

18. Location: N29°05'05"Lat. W89°09'51"Long.
Distributary of Johnson Pass near outlet into Garden Island Bay; depth of water 6 feet; 4-inch core of bottom sediment recovered.

19. Location: N29°04'27"Lat. W89°08'56"Long.
Johnson Pass, changeable shoal area near outlet into Garden Island Bay; depth of water 18 inches; 4-inch core of bottom sediment recovered.

20. Location: N29°05'16"Lat. W89°08'58"Long.
Loomis Pass, changeable shoal area near outlet into Garden Island Bay; depth of water 2 feet; 12-inch core of bottom sediment recovered.

21. Location: N29°03'47"Lat. W89°05'42"Long.
Garden Island Bay, shallow water near southern end of Balize Bayou; depth of water 6 feet; 10-inch core of bottom sediment recovered.

22. Location: N29°04'02"Lat. W89°04'26"Long.
Oyster Bay, southern end midway between swampland surrounding Balize Bayou and South East Pass; depth of water 2 feet; small bottom sample recovered from an oyster reef.

23. Location: N29°03'51"Lat. W89°14'20"Long.
East Bay, shallow water near right bank of South Pass; depth of water 4 feet; 6-inch core of bottom sediment recovered.

24. Location: N29°04'01"Lat. W89°15'21"Long.
East Bay, shallow water near Joseph Bayou; depth of water 2 feet; 12-inch core of bottom sediment recovered.

25. Location: N28°53'40"Lat. W89°20'35"Long.
Neritic off Southwest Pass; depth of water 125 feet; grab sample of bottom sediment recovered.

26. Location: N28°53'00"Lat. W89°20'05"Long.
Neritic zone of the Gulf of Mexico off Southwest Pass; depth of water 170 feet; grab sample of bottom sediment recovered.

27. Location: N28°55'29"Lat. W89°29'44"Long.
Neritic zone off Southwest Pass; depth of water 145 feet; sample of mud scraped from body of a shark caught on a trotline by professional fishermen.

28. Location: N28°58'40"Lat. W89°06'50"Long.
Neritic zone off South Pass; depth of water 60 feet; grab sample of bottom sediment recovered.

29. Location: N28°58'08"Lat. W89°06'30"Long.
Neritic zone off South Pass; depth of water 100 feet; grab sample of bottom sediment recovered.

30. Location: N28°57'30"Lat. W89°05'45"Long.
Neritic zone off South Pass; depth of water 150 feet; grab sample of bottom sediment recovered.

31. Location: N28°57'05"Lat. W89°05'15"Long.
Neritic zone off South Pass; depth of water 200 feet; grab sample of bottom sediment recovered.

32. Location: N28°56'30"Lat. W89°04'30"Long.
Neritic zone off South Pass; depth of water 245 feet; grab sample of bottom sediment recovered.

33. Location: N28°55'15"Lat. W89°03'45"Long.
Neritic zone off South Pass; depth of water 320 feet; grab sample of bottom sediment recovered.

34. Location: N28°54'45"Lat. W89°03'20"Long.
Neritic zone off South Pass; depth of water 380 feet; grab sample of bottom sediment recovered.

35. Location: N28°58'29.5"Lat. W89°08'45"Long.
South Pass mudlump No. 1, surface sample.

36. Location: N28°58'25.5"Lat. W89°09'06"Long.
South Pass mudlump No. 3, surface sample.

37. Location: N28°58'16.4"Lat. W89°08'34.3"Long.
South Pass mudlump No. 5, surface sample.

TABLE I — Distribution of Foraminifera in Environments and Mudlumps

	*	4	5	**	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Aaptostoma mexicana																					x
Ammoastuta salsa	x			x		x															
Ammobaculites cf. agglutinans	x																				
Ammobaculites burrwoodensis									x												
Ammobaculites diversus												x									
Ammobaculites southpassensis	x																				
Ammobulimina mexicana										x					x	x	x	x			
Amphistegina lessonii																					x
Angulogerina crenulata																		x			x
Angulogerina occidentalis																					x
Angulogerina selseyensis																					x
Archaias angulatus			x																		
Arenoparrella mexicana	x		x			x															
Articulina mayori																					x
Articulina cf. mucronata																					x
Bigenerina nodosaria textularoidea																					x
Bigenerina nodosaria exuda																					x
Bigenerina southpassensis																					x
Bigenerina southpassensis xenula																					x
Biloculinella labiata																					x
Biloculinella toddae																					x
Biloculinella ? sp. "A"																					x
Bisaccium imbricatum			x			x															
Bolivina acerosa southpassensis									x							x	x	x	x	x	x
Bolivina alata																		x			x
Bolivina albatrossi																					x
Bolivina cf. isidroensis				x																	
Bolivina subaenariensis balizensis																					x
Bolivina subaenariensis mexicana														x	x	x	x	x	x	x	x
Bolivina subspinescens																					x
Bolivina sp. "A"							x		x							x	x	x	x	x	x
Bolivina sp. "B"																		x			
Bulimina balizensis																					x
Bulimina exilis diminuta	x								x	x	x	x	x	x	x	x	x	x	x	x	
Bulimina marginata												x	x	x	x	x		x	x		
Bulimina pyrula															x	x		x			
B. (Desionbulimina) cf. illingi																					x
Buliminella elegantissima																					x
Cancris sagra												x						x			x
Candeina nitida																					x
Cassidulina laevigata																					x
Cassidulina laevigata carinata																					x
Cassidulina subglobosa																					x
Cassidulinoides bradyi																					x
Chilostomella oolina																					x
Chrysalidinella mexicana																					x
Cibicides floridana																		x	x		x
Cibicides sp. "A"																					x
Cibicidina cf. concentrica						x				x		x	x				x	x			x
Cornuspira planorbis																					x
Cornuspiroides foliaceum																					x
Dentalina atlantica																					x
Dentalina cf. calomorpha																					x
Dentalina cf. costai																					x
Dentalina hardingi																					x
Dentalina mucronata																					x
Dentalina vertebralis albatrossi																					x
Dentalina sp. "A"																					x
Discorbis bertheloti floridensis																					x
Discorbis candeiana																					x
Discorbis orbicularis																					x
Discorbis pulchra																					x
Dorothia caribaea																					x
Elphidium cf. excavatum																					x
Elphidium cf. fax fax																					x
Elphidium gunteri galvestonensis	x	x	x	x	x		x		x	x			x			x			x	x	
Elphidium lanieri																					x
Elphidium poeyanum	x		x	x		x		x													
Elphidium cf. translucens																					x
Enantiodentalina communis																					x
Epistomina elegans																					x
Eponides balizensis																					x
Eponides coryelli																					x
Eponides parantillarium																					x
Eponides umbonatus ecuadorensis																					x

Bulimina pyrula															x	x		x			x
B. (Desionbulimina) cf. illingi																					x
Buliminella elegantissima																					x
Cancris sagra												x						x			x
Candeina nitida																					x
Cassidulina laevigata																					x
Cassidulina laevigata carinata																					x
Cassidulina subglobosa																					x
Cassidulinoides bradyi																					x
Chilostomella oolina																					x
Chrysalidinella mexicana																					x
Cibicides floridana																		x	x		x
Cibicides sp. "A"																					x
Cibicidina cf. concentrica						x				x		x	x				x	x			x
Cornuspira planorbis																					x
Cornuspiroides foliaceum																					x
Dentalina atlantica																					x
Dentalina cf. calomorpha																					x
Dentalina cf. costai																					x
Dentalina hardingi																					x
Dentalina mucronata																					x
Dentalina vertebralis albatrossi																					x
Dentalina sp. "A"																					x
Discorbis bertheloti floridensis																					x
Discorbis candeiana																					x
Discorbis orbicularis																					x
Discorbis pulchra																					x
Dorothia caribaea																					x
Elphidium cf. excavatum																					x
Elphidium cf. fax fax																					x
Elphidium gunteri galvestonensis	x	x	x	x	x		x		x	x			x			x			x	x	
Elphidium lanieri																					x
Elphidium poeyanum	x		x	x		x		x													
Elphidium cf. translucens																					x
Enantiodentalina communis																					x
Epistomina elegans																					x
Eponides balizensis																					x
Eponides coryelli																					x
Eponides parantillarium																					x
Eponides umbonatus ecuadorensis																					x
Fissurina biparoda																					x
Fissurina centro-lucida																					x
Fissurina sp. "A"																					x
Flabellammina advena																x					
Frondicularia compressa																					x
Frondicularia sagittula																					x
Frondiculonodosaria nuda																					x
Gaudryina (Gaudryina) southpassensis																					x
Glandulina laevigata																					x
Globigerina bulloides				x															x		x
Globigerina conglomerata																		x			x
Globigerinella aequilateralis															x			x			x
Globigerinoides conglobata																					x
Globigerinoides rubra								x						x	x	x		x			x
Globigerinoides sacculifera																			x		x
Globorotalia menardii				x														x			x
Globorotalia menardii frimbriata																					x
Globorotalia tumida																					x
G. (Truncorotalia) hirsuta																					x
G. (Truncorotalia) punctulata																					x
G. (Truncorotalia) truncatulinoides															x			x	x		x
Guttulina pulchella																					x
Guttulina spicaeformis																					x
Haplophragmoides balizensis			x																		
Haplophragmoides manilensis			x			x															
Haplophragmoides cf. planissima																					x
Hastigerina cf. pelagica																					x
Karreriella bradyi																					x
Lagena cf. distoma																					x
Lagena gracillima mollis															x						x
Lagena hispidula															x						x
Lagena laevis nebulosa																					x
Lagena perlucida																					x
Lagena porteadsensis																					x
Lagena pyrama																					x
Lagena cf. striata															x						x
Lagena sulcata laevicostata																					x
Lagena sulcata spicata								x							x			x			x
Lagenonodosaria semihispida																					x
Lagenonodosaria semiintercellularis																					x
Lagenonodosaria pyrula																					x
Lenticulina cf. convergins																					x
Lenticulina peregrina																					x
Liebusella soldanii																					x
Loxostomum mexicanum																					x
Marginulina augens																					x
Marginulina cf. glabrata																		x			x
Marginulina cf. glabrata obesa																					x
Marginulina marginulinoides																					x
Marginulina striatula																					x
Marginulina subaculeata																					x
Marginulina villa																					x
Marginulina sp. "A"																					x
Marginulina sp. "B"															x			x			x
Marginulina sp. "C"																					x
Massilina southpassensis																					x
Miliolinella cf. californica																					x
Miliolinella porteadsensis																					x
Nodobacullariella atlantica																					x
Nodobacullariella sp. "A"																					x
Nodosaria fusta																					x
Nonion barleeana																					x
Nonion cf. depressulum matagordanum			x																		
Nonion faringai	x	x	x	x				x					x								
Nonion crawfordi	x	x	x	x		x	x														
Nonion grateloupi																					x
Nonionella atlantica																			x		x
Nonionella cf. auris	x			x			x			x	x	x	x	x	x	x	x	x	x	x	
Nonionella basiloba									x	x								x			x
Nonionella opima																					x
Oolina catenulata																					x
Oolina caudigera																					x
Oolina hexagona																					x
Orbulina universa															x			x			x
Parafissurina lateralis																					x
Patellina corrugata																					x

	*	4	5	**	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Oolina catenulata																					x
Oolina caudigera																					x
Oolina hexagona																					x
Orbulina universa																x		x			x
Parafissurina lateralis																					x
Patellina corrugata																					x
Pavonina sp. "A"																					x
Peneroplis proteus																					x
Planorbulina mediterranienensis																					x
Planulina faveolata																					x
Planulina mera																					x
Poroeponides lateralis																					x
Proteonina difflugiformis																x	x				
Pseudoclavulina mexicana																					x
Pseudoglandulina comatula																					x
Pseudoparrella howei									x	x	x	x	x	x	x	x	x	x	x	x	
Pullenia bulloides																					x
Pullenia quinqueloba																					x
Pulleniatina obliquiloculata																		x			x
Pyrgo cf. carinata																					x
Pyrgo cf. elongata																					x
Pyrgo nasutus																					x
Pyrgo nasutus balizensis																					x
Pyrgo nasutus southpassensis															x	x		x	x		x
Pyrgo subsphaerica burrwoodensis																					x
Pyrgo vespertilio																					x
Pyrgo sp. "A"																					x
Pyrgoella sphaera																					x
Quinqueloculina cf. bicostata																					x
Quinqueloculina burrwoodensis																					x
Quinqueloculina candeiana																		x			x
Quinqueloculina cf. glabrata																					x
Quinqueloculina cf. lamarckiana																					x
Quinqueloculina porteadsensis																					x
Quinqueloculina sabulosa																					x
Quinqueloculina porteadsensis																					x
Quinqueloculina sabulosa																					x
Quinqueloculina sp. "A"			x																		
Quinqueloculina sp. "B"																					x
Ramulina globulifera																					x
Rectobolivina advena																					x
Reophax dentaliniformis																x		x			
Reussella cf. miocena																					x
Reussella cf. spinulosa atlantica																					x
Robertina cf. bradyi																					x
Robulus balizensis																					x
Robulus bowdenensis																					x
Robulus burrwoodensis																					x
Robulus calcar																					x
Robulus calcar southpassensis																x	x	x			x
Robulus cf. clericii																					x
Robulus cf. cultratus																					x
Robulus cf. falcifer																					x
Robulus iotus																					x
Robulus iotus blowersi																					x
Robulus porteadsensis																					x
Robulus cf. serpens																					x
Robulus sp. "A"																					x
Robulus sp. "B"																		x			x
Robulus sp. "C"																					x
Rotalia beccarii parkinsoniana	x	x		x	x		x														
Rotalia beccarii tepida	x	x	x	x	x	x	x		x	x		x	x	x	x	x		x	x	x	x
Saccammina sp. "A"																			x		
Saracenaria cf. arcuata																					x
Saracenaria cf. italica																					x
Saracenaria latiformis jamaicensis																					x
Saracenaria southpassensis																					x
Saracenaria tripartita																					x
Sigmoilina cf. flintii																					x
Sigmoilina schlumbergeri									x												x
Sigmoilina tenuis																		x	x		x
Sigmomorphina sp. "A"																					x
Siphonina pulchra																					x
Siphotextularia affinis																					x
Siphotextularia concava																					x
Siphotextularia mexicana																					x
Sorites marginalis																					x
Sphaeroidina bulloides																					x
Sphaeroidinella dehiscens																					x
Spirillina vivipara																					x
Spiroloculina cf. antillarium																					x
Spiroloculina southpassensis																					x
Spiroloculina sp. "A"																					x
Spirophthalmidium sp. "A"																					x
Stomatorbina concentrica																					x
Textularia burrwoodensis									x			x		x	x	x		x			
Textularia candeiana																					x
Textularia clava																					x
Textularia conica																					x
Textularia corrugata																					x
Textularia foliacea occidentalis																					x
Textularia mayori																					x
Textularia mayori giganta																					x
Textularia mexicana																					x
Textularia sica																					x
Textularia sp. "A"																					x
Textulariella barrettii																					x
Tretomphalis cf. pacificus																					x
Triloculina insignis																					x
Triloculina cf. striatotrigonula																					x
Triloculina tricarinata																					x
Triloculina trigonula																					x
Trochammina inflata	x	x	x			x															
Trochammina cf. rotaliformis	x	x	x			x															
Uvigerina flintii																					x
Uvigerina cf. hispido-costata										x					x	x	x	x	x		x
Uvigerina proboscidea vadescens																					x
Vaginulinopsis cf. cibaoensis																					x
Vaginulinopsis cf. superba																					x
Valvulineria mexicana																		x			x
Valvulineria vilardeboana																					x
Virgulina complanata									x							x					x
Virgulina punctata																					x
Virgulina schreibersiana	x								x						x	x	x	x			x
Virgulina cf. tenuis																					x

*Composite of tidal stream collection localities 1, 2 and 3.
**Composite of distributary collection localities 6 through 20.

EXAMINATION AND THESIS REPORT

Candidate: Harold V. Andersen

Major Field: Geology.

Title of Thesis: A Recent Foraminiferal Faunules from the Louisiana Gulf Coast.

Approved:

H. V. Howe
Major Professor and Chairman

Richard J. Russell
Dean of the Graduate School

EXAMINING COMMITTEE:

E. E. Murray

Ale Sandberg

Fred Kniffen

B. A. Tator

Date of Examination:

May 25, 1950